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Allen Buckner Kanavel

1874-1938

ALLEN B. KANAVEL,
SURGEON, PRECEPTOR, FRIEND

THE kindly smile, the warm friendliness, the keen and genuine interest in every phase of life as it flowed about him—in short, that lovable personality that was Allen B. Kanavel, is but a memory. Gone, in a moment of tragic disaster, he has left a host of friends stunned and grieving.

Born September 2, 1874, the son of a Methodist minister, in a little town of central Kansas, he came to Chicago in 1891 to enter Northwestern University. After graduating from the college of liberal arts he entered the medical school, and graduated with honors with the class of 1899. Immediately afterward, as he once whimsically said, through the aid of an aunt who had more faith in him than good judgment, he went to Vienna, and spent six months in graduate study before entering upon his internship at the Cook County Hospital.

Immediately after its completion he became associated with the department of surgery at Northwestern University Medical School. When he asked Dr. Weller Van Hook, professor of surgery, for an opportunity to work in the surgical clinic he was told there were no places available, but if he wished he might observe the administration of anesthetics for the clinical patients and supervise their recovery immediately after operation. For a year he carried out this task and never once, he said, during that period had the opportunity of entering the operating room or of observing the performance of an operation. Years later with unobtrusive generosity he helped to lighten the burden of the closing years of his former professor, who had then become an impoverished invalid.

Early in his surgical career he became impressed with the haphazard and uncertain treatment accorded patients with severe infections of the hand. This interest led to a patient and painstaking study of the anatomy of the hand by a method not previously attempted—the forcible injection of an opaque material into the tendon sheaths and fascial spaces of the hand, and the careful observation of the route of spread and extension of the injected material. He learned that this extension followed a definite and constant pattern, and that from such observations it would be possible to predict with exactness the direction and extent of spread of an infectious process. He showed further how it would be possible to incise and drain the primary site of infection and the paths along which the infection extended with minimum damage to the vital structures of the hand. These studies, pursued over a period of nearly ten years, were incorporated in 1912 in a monograph on *Infections of the Hand*, recognized today as the basis

The first three lines are a paraphrase of the opening words of the beautiful unsigned tribute to Sir Robert Jones which appeared in the *Journal of Bone and Joint Surgery* in 1933, vol. 15, page 541

In spite of his acknowledged ability and success in the field of surgery there was absolutely nothing of the egotist about him. He often told the story of a distinguished visitor from New York who was suddenly seized with abdominal pain in his Chicago hotel. Dr Kanavel was called to see him, as were three other well known Chicago surgeons. Eventually Dr. Kanavel was asked to operate upon him, and the patient made a successful and uneventful recovery Just before the patient left the hospital Dr Kanavel said to the man's secretary. "I am interested to know why I was chosen to operate upon Mr Blank." At this point he would always remark with amusement and delight, "I thought of course he would say, 'We could not help but sense your surgical skill,' or 'Your surgical reputation extends far beyond Chicago.'" Instead came the reply, "Well. Mr Blank himself made the decision. He said 'Anyone as homely as Dr. Kanavel must surely be honest.'"

In St. Paul's Cathedral on a tablet over the north doorway is inscribed in Latin the beautiful and well known epitaph to Sir Christopher Wren. "If you would seek his monument, look about you" * One could with appropriateness apply the same words to the work of Dr. Kanavel. The sixty-six volumes of this "Blue Journal"—SURGERY, GYNECOLOGY AND OBSTETRICS—speak eloquently of the time and effort he bestowed upon it, as associate editor and editor, from the day of its beginning to the day of his death It was always close to his heart. He felt it was a vital force in making better surgeons and in helping the practitioners of surgery in America, particularly those outside the teaching centers, to keep pace with the rapid changes constantly going on in surgical practice.

Beside Dr. Kanavel's office and that of SURGERY, GYNECOLOGY AND OBSTETRICS you would see the beautiful Murphy Memorial building and the home of the American College of Surgeons. From its inception he was closely associated with Franklin H. Martin in its development and helped constantly to direct its activities Here again he felt was a definite and vital organization, not imposed upon the medical profession but growing up within it, which could help to raise and maintain high standards of surgical practice and hospital service in America, and so bring lasting benefit to suffering humanity

If you would look more widely you would see within the medical schools of Chicago and in most of its hospitals, and in many other schools and other hospitals, near and distant, graduates of Northwestern University Medical School striving to stimulate students, internes, and nurses, to teach them the principles of surgery as they learned them from an inspiring and stimulating teacher.

If you would look still further, in medical libraries and in the offices of surgeons throughout the United States, you would see in most of them *Infections of the Hand*, often affectionately referred to by Northwestern graduates as their Bible. You would find it not only in the United States but in Canada, in Great Britain and in foreign countries; you would find it in the Orient, translated into

*Si monumentum requiris, circumspice

for our knowledge of the adequate and efficient care of this common and often serious condition

By no means, however, did he confine his interest to infections of the hand. He was initiated into surgical practice at a time when most men were general surgeons, and the day of the specialist had hardly dawned. Rather than to speak of him as an able and skilled general surgeon it would be more correct to call him a specialist in many fields of surgery. His early association with Franklin Martin afforded him an opportunity for developing a wide experience and excellent technique in gynecological surgery. He was keenly interested in neurological surgery, he developed an original method of approaching the pituitary fossa through the nose, and skillfully performed operations upon the trigeminal nerve for the relief of tic douloureux and upon the spinal cord for pathological conditions involving the spinal pathways. He prepared the section on Neurological Surgery in Ochsner's *System of Surgery*. With Dr Charles Elliott he studied the problem of congenital hemolytic icterus and was the first in America to remove the spleen as the effective therapeutic procedure in this, in 1915, oft unrecognized disease. In fact it seemed as though everyone at Northwestern University or Wesley Hospital who was confronted with some unusual or difficult problem turned to him for help. Whether it was a patient with a serious burn requiring plastic work, a woman desperately ill from thyroid intoxication, a man with long continued drainage from an empyema cavity, a child with a congenital deformity of face, lip or hand, Dr Kanavel seemed to come first to the mind of the attending physician as the one best qualified to give expert help.

He was quite as much at home in the field of abdominal surgery as in that of the extremities, and though he never 'operated by the clock' if he ever chose to 'put on steam' it was extremely difficult for his assistants to keep pace with him. He could carry out routine procedures with unusual dexterity and lightning speed, but when working about the axillary vessels in performing a radical operation for carcinoma of the breast, or removing a congenital cyst close to the carotid sheath he was patience and gentleness personified.

Once when operating before a large group of visiting surgeons upon a patient with a huge retrosternal goiter an intrathoracic vein suddenly gave way with profuse and alarming hemorrhage. He quickly passed a finger behind the sternum, stopped the bleeding by pressure and then by sense of touch alone placed a hemostat on the torn vessel hidden in the thorax. Dr Charles Mayo said afterward it was the coolest performance under fire that he had ever witnessed.

On another occasion, after watching him remove through the posterior pharyngeal wall a bullet which had lodged just below the base of the brain between the occiput and atlas of a fifteen year old boy, Sir Berkeley Moynihan said that if ever he needed to have an unusually difficult operation performed on himself he wished Dr Kanavel might be there to do it.

THE PERSONALITY OF ALLEN B. KANAVEL

ALLEN B. KANAVEL will be known to posterity as a leader of surgical thought in America during his generation and will be remembered especially for his fundamental researches on infections of the hand. His monograph on this subject constitutes an authority recognized the world over. Even more important to his associates and former students, to the members of this faculty, and to his many friends and acquaintances—however valuable and far-reaching may have been his clinical and scientific achievements as a surgeon—is the memory of his individual, kindly, and stimulating personality.

Kanavel's career was shaped and directed by influences and circumstances, some of which may well be mentioned at this time. He was born 63 years ago last September second. His father was a pioneer Methodist minister, a man of strong character, active and influential in his community, a staunch Republican who later served as State Senator.

Kanavel was graduated from the college of liberal arts of Northwestern University in 1896, and from the medical school of Northwestern University in 1899. He served as interne in the Cook County Hospital after taking medical courses in Vienna. Finally he began the practice of medicine on the south side of Chicago in 1901. After a few months of general practice he decided to devote himself exclusively to surgery, which was his choice from the beginning. Opportunity for doing this was afforded by Dr. Franklin H. Martin, gynecologist at the Post-Graduate Hospital, and Dr. Weller Van Hook, surgeon at Wesley Memorial Hospital. The associations thus made were continued for many years.

In 1906 Kanavel joined Harry M. Richter and Frederic A. Besley in conducting a surgical clinic at the Post-Graduate Hospital. This proved an excellent training ground for all of them, open and frank criticism as to surgical procedures and pedagogic methods were freely exchanged. As a matter of convenience the three bachelors established themselves in an apartment near the medical school and hospitals, where discussions might be continued as long as desired.

Kanavel volunteered for service in the World War and was occupied principally in matters of organization and standardization of surgical procedures. He served a short period overseas and was finally advanced to the rank of colonel.

In 1907, when 33 years of age, he married Miss Olive Rosencranz of Evansville, Indiana, a Wellesley graduate of exceptional character, ability, and charm. They lived in an apartment on Chicago's south side. Neither Dr. Kanavel nor Mrs. Kanavel enjoyed living in the city, but the exigencies of surgical practice and of teaching in the city seemed to preclude their living elsewhere.

An address given at the Memorial exercises held in the Archibald Church Library, Northwestern University Medical School, June 1, 1938, following the tragic death of Dr. Kanavel on May 27, 1938.

Chinese, and everywhere looked upon as a court of last resort in the decision of difficult problems

Finally, if you could look deeply as well as widely, you would find in the minds and hearts of his students, his patients, his friends, and his associates lasting sincere admiration and deep affection for a man of splendid ability, of fine courage, of high ideals, never forgotten, and of generous and abiding faith in his fellow men

SUMNER L. KOCH

farm-implement manufacturing company founded in the early days by Mrs Kanavel's father at Evansville, in difficulty because of the depression. In all of these varied activities he showed amazing ability and helpfulness.

Kanavel possessed a remarkably keen mentality. He was purposeful and obviously had a great capacity for work, intelligently organized. His formula for successful investigation in medicine, in which he believed all should participate, was simple. There was no mystery about it in his mind. The formula was simply constant pursuit of intelligently directed thought. During the early days a soap-box in his apartment was the repository of notes and observation on infections of the hand. From this soap-box finally emerged the monograph that made its author world famous.

Kanavel had great tact. He avoided controversy. He was a master of diplomacy. He had a simple, homely charm, a shrewd common sense, unfailing courtesy. His interests were many but he rode no hobbies. He had a genuine interest in people, especially those with whom he came in frequent contact in professional and university circles. To his university and to his associates, he was loyal to a fault.

The welfare of young men in medicine, students, internes, residents, and assistants—and especially the welfare of the junior members of his department—was of paramount interest to Kanavel. He was quick to recognize and to reward merit. He was the inspiration responsible for the position attained by various former associates.

He was a master of effective extemporaneous speech. I recall his being unexpectedly called upon to address the members of the English Speaking Union in Sydney during a visit to Australia in 1927. He acquitted himself most creditably in a talk as appropriate, sincere, and quietly eloquent as any I have ever heard.

Kanavel read history and biography by preference but enjoyed a good mystery story. His memory of historical events and personalities was remarkable. He was a conversationalist of distinction and enjoyed discussion. He had a large repertoire of stories, clean cut and never vulgar. He loved games—any game, such as golf or bridge, and could improvise games on the spur of the moment. He was a hard man to beat and he liked to win. Natural science, in which Mrs Kanavel shared his interest, was a source of great enjoyment. Hiking, fishing, and camping trips by automobile and pack-train were keenly enjoyed, and the recollections of a number of them shared with him remain as fond memories.

The sudden, accidental and tragic death of Allen Kanavel has left a vacancy in the faculty of the medical school impossible to fill, and has saddened the hearts of all of us. We who enjoyed his friendship are grateful for the privilege of having worked with him. His influence, exerted in behalf of a generation of medical men, lives and will be transmitted in the years to come.

CHARLES A. ELLIOTT

The home they dreamed of building on the edge of a ravine in Glencoe never materialized. Both Dr and Mrs Kanavel were subject to colds, often severe and persistent, which were apparently induced by conditions of living within the city. The demands upon their time and strength were heavy and ever increasing, and became particularly burdensome for Mrs Kanavel. In their dilemma they finally, in 1924, sought freedom and a more wholesome out-of-door life in Pasadena, near the home of a favorite aunt. Later they established summer homes on the seashore at Del Mar and in the mountains at Big Pine, Inyo County, California, where they would, on occasion, seek refuge.

Since the Kanavels' desire for a family seemed to be denied them by nature, they finally decided to adopt children. Through the mediation of their friend, Dr Charles Paddock, obstetrician at St. Luke's Hospital, in whom they had confided, they were informed of the sad plight of an Army medical officer whose wife had died after giving birth to triplets. The Kanavels forthwith adopted the babies—two boys, who were identical twins, and a girl. The conscientious and efficient care bestowed upon the three incubator babies immediately, and continuously thereafter for fifteen years, was a matter of absorbing interest, not only to their parents but to all who knew the family. Needless to say, the assumption of the responsibilities of parenthood materially influenced the lives of both Dr and Mrs Kanavel.

Kanavel found it increasingly difficult to continue in the active practice of surgery because of the sensitivity of his hands to the frequent scrubbing and antiseptics of the operating room, this was a result of x ray burns sustained at the old Post Graduate Hospital. Consequently as the years went on he operated less frequently. He continued as active as ever in the editorial direction of SURGERY, GYNECOLOGY AND OBSTETRICS, in helping to shape the destinies of the American College of Surgeons and, until 1929, as chairman of the Division of Surgery at Northwestern. During this period he commuted between Pasadena and Chicago.

In 1932 Mrs Kanavel's health began to fail. From then on, until her death from leucemia in 1936, Dr Kanavel devoted himself to her care. He was successful throughout these trying years in keeping from her the knowledge of the nature and of the hopeless outlook of her illness. As a result they were able to enjoy several years more of happy family life.

During the last few years Kanavel suffered from the effects of frequent attacks of acute glaucoma, only partially relieved by medical care. Reading for more than an hour at a time became difficult and at times impossible. This was indeed a trial.

Kanavel continued active after "retirement." He continued as a guiding influence in the journal of SURGERY, GYNECOLOGY AND OBSTETRICS and in the American College of Surgeons. In addition he retrieved the ill fortunes of a

adherence to the principles previously referred to and had been the one chiefly responsible for its high editorial quality and for the choice of the contributions included in the pages of the journal.

Dr Kanavel was not only a great editor but, during the years of his association with the Journal, had perfected himself in the technique of surgery, had become an outstanding diagnostician, had occupied teaching positions—eventually becoming professor of surgery at Northwestern University Medical School. He found time to contribute monographs and books on various surgical subjects. He developed an exquisite literary style and his appearance upon any surgical program was a guarantee that his contribution would be illuminating. I doubt if Dr Martin could have found a more able lieutenant to assist him in the early days in the development of this magazine than Allen Kanavel proved to be, for the respect in which he was held by the surgical profession added luster to the Journal. Allen Buckner Kanavel, replete with idealism, untiring in constant effort to attain the highest, possessed of kindliness of soul, with sympathetic understanding of human frailties, leaves behind a record of a life well spent, a life worth while, an example for surgeons to emulate, and to those who knew and loved him, a memory to be revered.

J BENTLEY SQUIER

ALLEN B KANAVEL AND SURGERY, GYNECOLOGY AND OBSTETRICS

THE tragic death of Allen B Kanavel, while making us pause and reflect upon the uncertainty of life, brings a realization of how great a loss the surgical profession has sustained by his untimely death

To his friends, who are countless, his passing is a poignant grief, to his associates on the Editorial Board of SURGERY, GYNECOLOGY AND OBSTETRICS is the added sorrow of being deprived of the sagacious advice of their beloved councilor

It was by no mere chance that, after Franklin Martin had conceived the idea of founding a surgical journal, embracing advanced surgical thought, he enlisted in the project not only a group of the most eminent surgeons of the time but also a small group of younger men who had not as yet established their reputations as master surgeons This younger group became the wheel horses of the organization and, as the years passed, the wisdom of his choice became increasingly manifest Among this younger group was Allen B Kanavel who held the position of associate editor from the first edition of SURGERY, GYNECOLOGY AND OBSTETRICS on July 1, 1905, until the death of its Founder thirty years later After Dr Martin's death he became editor in chief

The surgeons of America and abroad who have watched the growth of this Journal over a period of thirty three years recognize the determining factor which Dr Kanavel's influence has had upon its literary excellence and surgical appeal

Certain principles of policy had been laid down—*"The Journal was to be of practical value to the practicing surgeon Every endeavor was to be made to foster the scholarly and scientific aspirations of the surgical profession It was to be truly an international journal It was to represent the highest type of book making with adequate illustrations and conservative literary style No personal prejudices or commercial considerations were to influence its editorial policy These were the words of Allen B Kanavel in his contribution to the 25th anniversary number of the Journal, they sum up the ideals which have been faithfully followed Even in the early years of Dr Kanavel's association with the Journal his viewpoint on the policies to be followed, the articles to appear in the Journal carried great weight with the editorial board and the wisdom of his judgment became so apparent to all who worked with him that there were rarely differences of opinion"*

As the publication grew it received the respect and endorsement of surgeons at home and abroad and the roster of contributors to SURGERY GYNECOLOGY AND OBSTETRICS would almost be a roster of the famous surgeons of the world of the past thirty five years During all these years, Dr Kanavel had been firm for

principles of scientific medicine and instructed in the simpler procedures necessary for home nursing, will a gap be filled in our system of medical instruction, the standards of professional service improved, fraternal spirit engendered, and to the hospital will be attached the warm and sympathetic support of the public "

Dr. Kanavel was a member of the Committee on History Reviews from 1923 to 1926, aiding in the annual review of the approximately 650 sets of histories which are submitted each year. As an editor of SURGERY, GYNECOLOGY AND OBSTETRICS he presented each year the prize which has been offered by that Journal since 1931 for the most acceptable set of medical records presented by any candidate for Fellowship during the preceding year.

He was a member of the Committee on Graduate Training in Surgery in 1936 and of the Library Committee from 1936 to 1938.

In the deliberations of all these committees his contributions were always wise and based upon deliberate judgment of the values of the matters under discussion.

Dr. Kanavel was president of the American College of Surgeons for the year 1931-1932. The following brief excerpts from his inaugural address and from his address as retiring president sum up well his conception of the purposes and spirit of the College.

"The justification of any medical organization lies in the unselfishness of its ideals, its achievements come from its initiative and freedom from guild fundamentalism, and its permanence rests upon its service to the public . . .

"The American College of Surgeons is interested not alone in assuring competent care to the sick, but also in advancing the frontiers of medical knowledge. In our intense study of the obvious and practical we should not neglect to emphasize that unselfish service, personal and professional honesty, the desire to seek new truths, industry, broad culture, judgment and imagination, even more than technical efficiency, are the qualities that have given American surgeons an enviable position in international surgery."

By these last words Dr. Kanavel unwittingly described himself. Above all else he was fair-minded and he was just, and these two qualities are the prime reasons for Dr. Kanavel's great and continuing influence in Northwestern University, in SURGERY, GYNECOLOGY AND OBSTETRICS, in the American College of Surgeons, in medicine itself.

GEORGE CRILE

DR KANAVEL AND THE AMERICAN COLLEGE OF SURGEONS

DR AILLN B KANAWEI was a brilliant student in the University and in the Medical School. By the collaboration of a keen mind and a cunning hand he achieved eminence in surgical technique in the most intricate field of surgery. Dr Kanavel possessed these fundamental characteristics—ability, character, the will to serve, the capacity for calm deliberation. He was essentially an artist—none but an artist could so reconstruct and remodel deformed hands, could write such beautiful English, could speak with such unusual grace and facility.

These very characteristics made him a figure of outstanding influence in the American College of Surgeons which he served continuously from its inception. Not only was Dr Kanavel a Founder and Life Member of the College but he was also a member of the committee which organized the Clinical Congress of Surgeons and was the treasurer of the Congress during the seven years of its independent existence antecedent to the foundation of the American College of Surgeons.

He was a Regent and a member of the Executive and Finance Committees from 1913 to the time of his death. He was a member of the Board of Governors from 1913 to 1918 and from 1921 to 1927.

Even before the inception of the College Dr Kanavel had been interested in hospital standardization and at the business meeting of the Clinical Congress held in New York in 1912 he presented a resolution which provided that "some system of standardization of hospital equipment and hospital work should be developed to the end that those institutions having the highest ideals may have proper recognition before the profession and that those of inferior equipment and standards should be stimulated to raise the quality of their work" and that "the president of the Congress be authorized to appoint a committee from the profession delegated to carry the spirit of this resolution into effect and report to the Clinical Congress in 1913." Dr Kanavel was appointed a member of this committee. He was a member of the Committee on Standards for Illinois from 1917 to 1919. This committee developed a plan including a minimum standard of equipment and of efficiency which formed the basis for the first classification of hospitals.

His conception of the value of the hospital as a teaching center is well summed up in the conclusion of an address given by him at the Hospital Standardization Conference in St. Louis in 1932:

Thus, with the conception of the standardized hospital as a teaching center, where the interne will secure a better training for practice, the aspiring specialist receive his instruction, the general practitioner find his postgraduate teaching, and the public be informed of the

BIOGRAPHICAL OUTLINE

Born in Sedgwick, Kansas, September 2, 1874, son of George W and Mary (Paugh) Kanavel
 Died near Mojave, California, May 27, 1938
 Northwestern University, A.B., 1896
 Northwestern University Medical School, M D. (cum laude) 1899
 Northwestern University, D Sc.(Hon), 1924
 Postgraduate course in Vienna
 Married Olive Rosencranz of Evansville, Indiana, 1907
 Children. Richard, David, and Patricia
 Attending Surgeon, Cook County Hospital, 1913-1919
 Attending Surgeon, Wesley Memorial Hospital, 1910-1938
 Attending Surgeon, Passavant Memorial Hospital, 1929-1938
 Instructor in Clinical Surgery, Northwestern University Medical School, 1902-1907
 Associate in Surgery, Northwestern University Medical School, 1907-1908
 Assistant Professor of Surgery, Northwestern University Medical School, 1908-1917
 Associate Professor of Surgery, Northwestern University Medical School, 1917-1918
 Professor of Surgery, Northwestern University Medical School, 1919-1938
 Chairman, Division of Surgery, Northwestern University Medical School, 1920-1929
 Associate Editor, SURGERY, GYNECOLOGY AND OBSTETRICS, 1905-1935, Editor, 1935-1938
 Founder, Regent, President (1931-1932), American College of Surgeons
 Colonel, Medical Corps, U S Army Served in Surgeon General's office and as Consultant for A E F in France

MEMBER OF MEDICAL AND OTHER ORGANIZATIONS

American College of Surgeons
 Chicago Medical Society
 Chicago Surgical Society
 Illinois Medical Association
 American Medical Association
 Institute of Medicine of Chicago
 Society of Medical History of Chicago
 Society of Clinical Surgery
 American Surgical Association
 Western Surgical Association
 Interstate Post Graduate Medical Association of North America
 Société Internationale de Chirurgie
 Corresponding member, Royal Institute of Clinical Medicine, Rome
 University Club of Chicago
 Anandale Country Club of Pasadena, California

ALLEN B KANAVEL AND HIS MILITARY SERVICE

IT was my pleasure to have known Dr Allen B Kanavel for many years. I was first attracted by his writing on various surgical subjects. The subject matter, the clarity of expression, together with his familiarity with his subject in all his writings, were quite evident. One could learn much from his contributions to our knowledge of the subjects upon which he wrote.

He had a most attractive personality, and in France, during the War, I was greatly indebted to him for the valuable assistance rendered by him at our Surgical Headquarters, where he filled with great satisfaction the position of Assistant to the Chief Consultant in Surgery. He was most helpful in every way, and his judgment and his ability to size up the different men for different positions of responsibility could always be relied upon. He entered service as Major in the Medical Corps, U S A, reported for duty November 19, 1917, and was assigned to the Division of Surgery, Surgeon General's Office. His duties were principally concerned with the recruiting and assignment of surgical specialists. Later he became Lieutenant Colonel, and in August, 1918, was appointed Colonel in the Medical Corps. In September, 1918, he was relieved of duty in the Surgeon General's Office and was ordered to France to serve as Assistant to the Chief Consultant in Surgery of the American Expeditionary Forces.

The profession of surgery has lost one of its outstanding representatives—a man who stood for the best, and whose absence will be greatly felt.

J M T FRANEY

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A 1



A 2



A 3



A 4



B 1



B 2



B 3



B 4



C 1



C 2



C 3



C 4



D 1



D 2



D 3



E 1



E 2



E 3



E 4



F 1

Electrocoagulation of Four Hundred Cervical Cross-sections—a Photographic Study
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NUMBER I

ELECTROCOAGULATION OF FOUR HUNDRED CERVICAL EROSIONS—A PHOTOGRAPHIC STUDY

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THE subject of cervical erosions has in recent years attracted considerable attention. Because of its high incidence and persistence we believe that it will not be ill timed to give this condition a more detailed study. The trend of thought of recent writers on the subject conforms with the opinion held by Curtis, namely, that the cure of the lacerated and infected cervix is a most potent prophylactic measure in the elimination of cancer of the cervix. Crossen reminds us of the frequency of cancer

in this location, and states that chronic cervicitis is apparently the important factor. The subject, therefore, becomes of interest to those of us who believe that chronic infection and irritation play a part in the etiology of cancer.

Further interest is added when we become aware of the steadily growing conviction among gynecologists that the infected cervix can be added to the list of other recognized foci, namely, teeth, tonsils, the sinus, and prostate. Attention has been called by C. H. Davis to the relief of arthritis subsequent to the cautery treatment of a streptococcal infection of the cervix and by Offutt to the rôle of cervicitis in iritis, low grade pelvic cellul-

From the Women and Children's Hospital, Chicago, and the Genito-Urinary out patient department, Rush Medical College, Chicago.

Colored photographs demonstrated before American College of Surgeons meeting October 26, 1937, Chicago.

Colored plate

A. Chronic cystic cervix, with endocervicitis in patient, Mrs. H., aged 46 years, mother of 2 children, 16 and 18 years. Patient had severe backache and feeling of weight in pelvis and profuse discharge, frequency of urination. 1, Before treatment, 2, September 17, 1937, gray slough present immediately following coagulation, 3, December 14, showing healed erosion, canal not fully healed, 4, January 18, 1938, 4 months later, cervix entirely healed.

B. 1, Polypoid erosion. Mrs. C., aged 28 years, mother of 2 children, 4 and 6 years. A metal stem pessary was removed in August, 1937. 2, September 21, 1937, immediately following coagulation, note black eschar sometimes formed when it is necessary to stop a heavy bleeder following biopsy. The gray slough is more desirable. 3, Two weeks later, slough off, 4, December 21, healed cervix 3 months later.

C. Extensive erosion. Mrs. W., aged 40 years, quintip-

ara, last child, 1931. Treated by coagulation, October 26, 1937. 2, November 16, closer focus, 3 weeks following coagulation, shows squamous epithelium growing in over eroded area, 3, December 7, further healing. Canal retouched with electrode at this date, 4, Complete healing, January 25, 1938, 3 months later.

D. 1, Spongy erosion. Mrs. D., aged 37 years, had child 15 years ago, sterile since. 2, December 7, showing canal coagulated. Upper and lower lips coagulated December 21, 2 weeks later. 3, March 1, 1938, erosion healed 10 weeks following coagulation.

E. 1, Erosion of upper lip and canal. Mrs. F., aged 40 years, quadripara. 2, November 10, 1937, upper lip and canal coagulated, 3, January 11, 1938, upper lip healed and retracted, lower lip to be done at a later date.

F. 1, Follicular cervicitis. Mrs. I., aged 30 years, tripara. Follicles coagulated November 30, 1937. Erosion of the cervix coagulated 1 year previously. 2, January 25, 1938, cervix healed 8 weeks following coagulation.

litis, and nephritis. Langstroth is convinced that the cervix as a focus is second to none as a factor in nervous and mental diseases.

Infertility as a sequel of endocervicitis has been stressed by Kimble and by Adair, and Mathews mentions the frequency with which conception follows the cure of the lesion. The quotations are numerous and indicate the importance of this segment of the uterus.

This report is based on a study of 400 cases of cervical erosions collected during the past 5 years, from both clinical and private practice. The treatment has been limited to electrocoagulation of the lesions with a spark gap diathermy machine. Description usually being inadequate in this type of work, colored photography became a very satisfactory means of demonstrating results.

DEFINITION AND PATHOLOGY

The term cervical erosion is synonymous with chronic cervicitis and is referred to by Goodall and Power as "ectropion." This in brief is a red, vascular, well demarcated and sometimes raised area, surrounding the cervical os and involving part or all of the cervix. It always extends into the canal of the cervix because therein lies its source, a chronic cervicitis, and a chronic endocervicitis are co-existent. The erosion will not form if there is no chronic infection in the canal. The erosion is a benign lesion. It is usually covered by a thick, mucous or mucopurulent discharge, which can be seen exuding from the os.

A more accurate understanding may be had from a consideration of the pathology. The consensus of various writers is that there is originally an endocervicitis with involvement of the racemose and deeply burrowing cervical glands of the canal. The infection produces a hyperemia which stimulates this glandular epithelium of the canal to hyperplasia and hypersecretion.

The protective vaginal squamous epithelium, covering the cervix to the os, is thus macerated and injured by contact with the alkaline mucopurulent discharge and by the downspread of the endocervical infection and as a result the superficial layers are desquamated. According to Falk, this raw surface around the os is the true erosion and its over-

growth by the deep red, hyperplastic alkaline resistant, columnar epithelium of the canal constitutes the first stage of healing. It is this latter stage that is referred to as "ectropion" or eversion. Adair states the "cervical lesion" itself is characterized microscopically by a partial or complete loss of surface epithelium with a partial or complete replacement with atypical epithelium. No destruction of the subepithelium is present thus distinguishing erosions from ulcers.

Histologically, our sections show a layer of columnar cells covering the base of the eroded area. But whether this is a downspread of the columnar epithelium from the canal or merely the basal layer of squamous epithelium which resembles columnar epithelium, we are not in a position to say (Fig. 1).

The surface of the chronically infected cervix is often studded with many small gray cysts. These are believed to be retention cysts due to the obstruction of the displaced racemose glands originally of the cervical canal. They are usually obstructed by an overgrowth of new squamous epithelium in the process of healing. The increase in the size of the chronically infected cervix is explained by edema, fibrous replacement, round cell infiltration, and increase in the number of deep retention cysts. The proliferation of glandular columnar epithelium of the canal into rugae, often produces the deep red polyps seen protruding from the os in chronic cases. The cervical distortion occasionally seen is usually due to a previous laceration of the cervix following a delivery or following surgery to the cervix.

We believe that healing takes place only after the alkaline discharge ceases and the squamous epithelium of the portio vaginalis again covers the area. This means that all the endocervicitis and the atypical epithelium covering the erosion must be destroyed. We believe that electrocoagulation does this effectively.

ETIOLOGY

Of 1,380 adult female new admissions to the out-patient department of the Women and Children's Hospital for 1937, 621, or 45 per cent, had examination of the cervix with a speculum. Of these 621 patients, cervical erosions were found in 279. Sixty-two or

TABLE I—AGE INCIDENCE IN 400 CASES
CERVICAL EROSION

	Cases	Per Cent
Below 20	4	1
20-29	137	34
30-39	179	45
40-49	71	17
50-59	8	2
85	1	

TABLE II—OTHER ASSOCIATED FACTORS

	Cases	Per cent
Multipara	364	91
Nullipara	36	9
Symptoms dated to last delivery	119	33
Previous miscarriage	38	10
Symptoms dated to last miscarriage	10	26
Definite frequency and nocturia	44	11

roughly only one-fourth to one-fifth of all erosions were referred to diathermy for coagulation. Although 279 erosions would be only 20 per cent of the 1,380 cases admitted, it would be 45 per cent of the 621 cases examined vaginally. We may safely say, therefore, that the incidence of erosion in this particular clinic lies somewhere between 20 to 45 per cent of all women entering. Of the 400 patients treated by coagulation, 179, or 45 per cent, were between the ages of 30 to 39, and 80 per cent were under 39, the average age was 33.2 years. This shows a definite relation to the childbearing age. Age variation as shown in Table I was from 17 (1 case) to 85 (1 case).

We have found that the symptoms of erosion have often dated to the time of the last delivery, the last miscarriage, the last curettage, or the last gonorrheal infection. Thirty-three per cent of our patients definitely date symptoms to the last delivery (Table II). We have often seen it following the use of the stem pessary. Occasionally, we have observed one with no apparent cause. This is the very mild type seen in young nulliparous and unmarried women, referred to by some authors as the virginal type of erosion. Other causes mentioned in the recent literature are forceps delivery and trichomonas infection. The latter, we have observed twice to be associated with a mild type of erosion.

The significant fact to be noted from all these conditions which are listed as etiological factors is that they all produce some injury to the cervical canal. Mathews found that the



Fig 1 Section through an erosion. Mrs K, aged 22 years. Extensive deep red lesion covering almost entire cervix. Section shows appearance at time of examination 3 months following delivery. Biopsy taken through vaginal portion of cervix. Note presence of cervical glands, columnar epithelium, infiltration of cells—predominantly small lymphocytes, absence of squamous epithelium, and increased vascularity.

staphylococcus, the streptococcus, and the *Bacillus coli* are present in chronic endocervicitis. Herrold has cultured the streptococcus and a type of enterococcus from cervical lesions. Hence after the initial damage has been done to the canal, these organisms firmly establish themselves in the deep racemose glands and produce a chronic endocervicitis. This infection may extend downward and produce erosion, and it may occasionally extend upward and produce an endometritis. If the infecting organism is a streptococcus or a gonococcus, the cervix may at the same time act as a focus of infection, and remain a cause of an associated chronic arthritis.

SYMPTOMS

Being an area of very little sensation, the symptoms arising from the cervix directly are negligible. In the great majority of our patients, the only symptoms were discharge and backache. The symptoms complained of by "erosion" patients can be divided into five groups.

1. Those due to the obstruction of the cervical canal by the endocervicitis and cyst

formation, these are dysmenorrhea bearing down pains, feeling of weight in the pelvis, lumbosacral pain, and sterility

2 Those due to the discharge, namely *pruritis vulvæ*

3 Those due to the erosion itself, bleeding between periods, and dyspareunia

4 Those due to an associated trigonitis, namely frequency and urgency of urination

5 And finally, those due to latent effects of the cervix as a focus of infection, namely arthritis and iritis (We have seen no associated iritis)

Such symptoms as nervousness, headache, fatigue, and mental distress frequently seen in these patients may be classed in either this latter group or attributed to a definite fear of malignancy

We have found frequency of urination to be noted in about 11 per cent of the histories examined. Frequency of urination is often associated with an accompanying cystocele, trichomonas infection, stricture of the urethra, urethral polyps, or caruncle urethra, and must not be attributed to the erosion. Winsbury White has demonstrated lymphatic connections between the cervix, vagina, bladder, and kidney, and states that 'cystoscopy shows that bladder inflammation (in erosion) is localized to the trigone. All degrees of inflammation are met with from mere hyperemia to ulceration, and inflammation may have spread to other parts of the vesicle mucosa. Herrold found symptoms of frequency associated with the presence of bacteria in the urine of erosion patients

We have never observed any involvement as severe as ulceration of the trigone. However, as a matter of curiosity, we cystoscoped 20 consecutive erosion patients. Cystoscopy showed definite trigonitis in 4 patients, and 3 of these had marked symptoms of nocturia and frequency. The cause of the frequency and nocturia in 2 other patients was definitely due to an associated trichomonas infection and cannot be attributed to the erosion. One of the trichomonas cases had a marked trigonitis (Table IV)

In all 4 cases where the trigonitis was associated with the erosion alone and not with a trichomonas infection the symptoms of fre-

quency and nocturia as well as the inflammation of the trigone had disappeared with the healing of the cervix

STERILITY

Of these 400 cases there were 23 who complained of sterility. Seven, or 34 per cent of these 23, never had been pregnant and 16 or 65 per cent, had a previous pregnancy. Of this latter group of 16, only 9 returned for a follow up study and 4 of these had become pregnant following coagulation treatment. The remaining 5 remained sterile, 1 had been separated from her husband since birth of first child and 2 showed reddening of cervical canal or a recurrent endocervicitis. The incidence of fertility subsequent to coagulation, namely 4 cases may, therefore, be interpreted to be 25 per cent (in relation to the total 16 cases) or 44 per cent (in relation to the 9 cases who returned for examination). We have often seen pregnancy occur in the presence of a severe erosion, but we believe that conception is much less likely to take place in the presence of this lesion. Kurzrock and Miller state that 'there is a lytic substance in human semen which will disintegrate a normal cervical mucus plug. Its activity is stopped by the presence of pus in the mucus.' Hence penetration of this mucus plug by spermatozoa becomes difficult if not impossible in such a condition as endocervicitis. This seems to be indicated by the observation that in 39 of the 400 women each had 1 child and then no other, some even after intervals of 10 to 15 years following the first delivery. These patients did not complain of sterility and are not listed as sterility patients. But judging from their careless use of contraceptives it is hard to believe that their sterility was 100 per cent voluntary.

RELATIVE VALUE OF CERVICAL THERAPY

The methods of treatment to which the cervix has been subjected in the past can be grouped into four main heads: (1) chemical including all types of caustics and dyes; (2) surgical including conization and the Sturmdorf operation; (3) thermal including cauterization and (4) electrical including coagulation.

TABLE III—RESULTS ELECTROCOAGULATION
400 CASES CERVICAL EROSION

	Cases	Per cent
One treatment only	330	82
More than one treatment	70	18
Healed in 10 weeks or less	296	75
Healed in more than 10 weeks	104	25
Recurrence after 1 year or more	28	7

A knowledge of the nature of the deeply infected racemose glands of the canal will immediately warn us away from such futile agents as silver nitrate, iodine, phenol, mercurochrome, gentian violet, or such procedures as alcohol injections and irrigation. These are palliative, but not curative in all but the very mild type of erosions.

"Surgery of the cervix," states Kimble, "is no longer considered the method of choice." Adair believes that conization and surgery should not be employed where future child-bearing is contemplated. We feel that such a radical hospitalizing procedure is unnecessary in the light of the highly successful results obtained with coagulation in cervices which have previously been considered surgical. The objections to the Sturmdorf procedure are brought out by Wolf who shows that 1 of 5 have poor results. Goodall very vigorously states that amputation of the cervix for the cure of endocervicitis is an "ostrich-like subterfuge," because of late septic hemorrhage and lack of primary union.

The results of the cautery treatment of the cervix approach those of coagulation the closest. There are, however, strong objections to the cautery treatment. Goodall's use of the cautery by just producing a parboiled appearance of the cervical os rather than a charring, resembles coagulation very closely and probably accounts for his good results with the cautery. He emphasizes the harmful effects of deep cautery to the canal, saying that it may make dilatation at subsequent labors difficult. Mathews, another proponent of the cautery, agrees that too deep cautery may produce a stenosis of the os cervicis.

While cauterization of the cervix has been in use for some time, electrocoagulation is a recent procedure as far as the cervix uteri is concerned. Hunner in 1906, first advocated the use of the cautery for the cure of cervicitis. Dickinson in 1921 recommended a similar pro-

TABLE IV—CYSTOSCOPIC FINDINGS IN 20
CONSECUTIVE EROSION PATIENTS

Type of erosion	Urinary symptoms	Cystoscopic findings	Other infection
8 Moderate	None	None	None
6 Severe	None	None	None
Moderate	Frequency, nocturia	Trigonitis	None
Moderate	Frequency, burning	Trigonitis, inflammation right ureteral orifice	4+ Wassermann
Severe laceration	Frequency, nocturia	Trigonitis, cystitis	None
Severe	None	Trigonitis	None
Mild	Frequency, nocturia	Urethritis	Trichomonas V
Mild	Frequency, nocturia	Trigonitis, cystitis urethritis	Trichomonas V
Total 20 cases	3 with symptoms due to erosion (15 per cent)	4 with associated trigonitis (20 per cent)	

cedure with radial incisions of the os. However, it was not until 1926 that any reference was made in the literature to electrocoagulation of the cervix.

This was made by two Frenchmen, Flandrin and Schil, who reported a year's work with a "sparking current." They claimed exceptionally quick healing, soft scars, and subsequent pregnancy. (They used a spark-gap machine.) Moench and Schulman in 1930 prepared a preliminary report on electrocoagulation of the cervix. They concluded that the effects of coagulation were as good if not better than cauterization with the added attraction of less danger from stenosis and greater ease of handling. The senior author (O. Z. B.) has been using this form of therapy since 1926.

We prefer this treatment over cautery or surgery because of the following definite factors:

The procedure is simple and quick; it is ambulatory, it is positive, it will allow subsequent pregnancies, it will not produce stenosis; it will rarely have postoperative complications of bleeding; it needs no hospitalization of patient; it needs no packing, it needs no anesthesia, and there is no need to grasp the cervix with a tenaculum.

We do not recommend the use of the cherry bipolar electrode. This produces a coagulation



Fig 2 Normal cervix Mrs G aged 34 years. One child 1924. Cervical erosion coagulated October 26 1937 healed December 8 1937 6 weeks later. Biopsy taken January 4 or 10 weeks following coagulation (mouth of cervix). Note normal appearance of stratified squamous epithelium and columnar like cells of its basal layer. (Same magnification as Fig 1)

of the cervical canal it is true, but because of the high percentage of stenosis produced with this electrode in the patients on whom it was used we have never gone back to it again. We have found that there is a much greater margin of freedom and safety with the unipolar "blunt needle" electrode. Falk also calls attention to the poor results of coagulation with the bipolar electrode.

TECHNIQUE

The treatment was limited to the electrocoagulation of cervical erosions with a spark gap machine. Other types of cervical lesions are rare and were weeded out in the other departments by smears cultures dark field, and biopsy, before being referred for diathermy. The cases were not selected and except for certain definite but infrequent contra indications every type of erosion sent in was treated. These varied from the simple small erosions including the so called vaginal type to the extensive, raised erosions involving almost the entire cervix. These were often associated with lacerated, edematous, and hypertrophied cervixes and were complicated

by polyps cysts, and follicles—the type many writers refer to as the surgical cervix.

Anesthesia is not necessary. It is the very rare patient who complains. The mucus is wiped from the cervix so that the extent of the lesion may be seen. It is not removed from the cervical canal because we believe that the fluid distributes the heat more evenly in the canal following the insertion of the electrode.

A spark gap diathermy machine was used. The indifferent electrode was connected to an aluminum abdominal pad, the active electrode from the low voltage terminal to the needle electrode, held in a bakelite handle. The needle is inserted into the canal to a depth of about a half inch and removed when a whitish circumference appears at the os after which the point of the electrode is just touched to the erosion until a whitish gray circular area appears. This is repeated each area overlapping the next until the entire erosion is coagulated white (Fig 3).

We believe with Frost that the bactericidal effect of the heat from the coagulating current extends deeper than 1 to 2 millimeters down into the cervix, and hence gets to the deeply infected racemose glands. This is proved by the repeated experience that if the erosion alone is coagulated and the canal neglected the erosion is very apt to recur; however, if the canal alone is coagulated the erosion will often heal spontaneously. By pressing the needle to the erosion, before stepping on the foot switch, we avoid a sparking current, and hence, we avoid the production of charring. Coagulation is to be preferred to charring.

Frost was unable to detect histologically any sign of scar tissue underlying the newly formed squamous epithelium following coagulation. The accompanying photomicrograph shows a healed cervix 10 weeks following coagulation having every appearance of a normal cervix (Fig 2).

A thin rubber tube from a cigarette drain is placed around the jaws of the speculum for the purpose of keeping the vaginal walls from falling into view and gives a good vision during photography or treatment. We find that the metal speculum is no handicap to coagulation. We have often connected the indifferent electrode to the speculum instead of

using a metal abdominal pad. When the rubber cigarette tube is used, however, this cannot be done because of the insulating effect of rubber.

Obstruction of the canal sometimes occurs following coagulation, and is due to the slough in the canal. This usually produces symptoms of back pains and cramps. Therefore, as a follow-up treatment to prevent this condition, we insert a thin mercurochrome-dipped applicator into the canal once a week until healing is established. This allows uterine drainage and relieves the symptoms immediately.

CONTRA-INDICATIONS

If coagulation is done too close to the menstrual period, there is apt to be troublesome bleeding during and following coagulation. This can be stopped by re-touching the bleeding area with the electrode or applying a small applicator dampened with Monsel's solution for a few minutes. Because of the associated bleeding, we have made it a rule not to coagulate 10 days before or after the menstrual flow.

Acute gonorrhea of the cervix is never coagulated. Chronic gonorrhea of the cervix is coagulated and often is the only way in which this persistent infection can be cured.

Kimble finds that there is often a rapid subsidence of complicating chronic pathology following coagulation. This may be true of chronic conditions, but we believe that it is best to wait until symptoms of any suspicious acute or subacute pelvic conditions subside before coagulating. Failure to heed this rule gave us cause for concern in one instance, namely immediately following coagulation, the patient had an acute attack of pelvic pain and developed a fever of 103 which persisted for a few days, before subsiding. It was not until after the coagulation that we learned of a previous history of salpingitis and of the finding of a suspicious mass in the pelvis at a previous examination by her physician.

Although Frost states that coagulation of the cervix during the first 3 months of pregnancy is permissible we have not made it a practice to coagulate the cervix or canals even in the early months of pregnancy first, because there is some danger of inducing

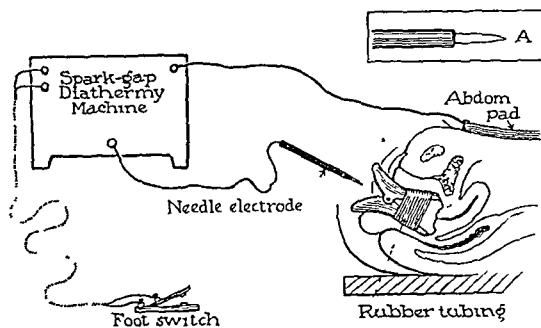


Fig. 3. Diagram of equipment used in electrocoagulation of the cervix. Insert A, Actual size and shape of tip of coagulating electrode (Fischer).

abortion and, second, there is always apt to be excessive bleeding from the pregnant and vascular cervix following coagulation.

In most instances the canal and both lips of the cervix were coagulated at the same time. In the severe erosions, however, only one lip was coagulated at a time.

The number of treatments varied from 1 in 330, or 82 per cent, to 2 or 3 in 70, or 18 per cent, of the cases, usually the more severe or cystic erosions (Table III). We have always preferred to coagulate the more involved cervixes 2 or 3 times rather than attempt a single heavy coagulation. With this procedure we have seen no stenosis. Slight contractions of the cervical os may and do occur by overcoagulating. These, however, are soft scars and are easily dilated. This cannot be said of the stenosis following cautery, for which the patient will occasionally need a general anesthetic for dilatation of the cervix.

The patients are given an ichthyol tampon following the coagulation and told to retain it for 2 days. They are advised against douching and intercourse for 3 to 4 weeks. After this, they are allowed to douche with a mild iodine solution. We find that 296, or 75 per cent, healed in 10 weeks or less, and 104 or 25 per cent took more than 10 weeks to heal. A few were healed only after 6 months' time and with repeated coagulation. Recurrence after 1 year or more occurred in 28, or 7 per cent of cases (Table III).

As to the effect of coagulation on the subsequent dilatation of the cervix, our experience has been that after coagulation women



Fig 2 Normal cervix Mrs G aged 34 years One child 1924 Cervical erosion coagulated October 26 1937 healed December 8 1937 6 weeks later Biopsy taken January 4 or 10 weeks following coagulation (mouth of cervix) Note normal appearance of stratified squamous epithelium and columnar like cells of its basal layer (Same magnification as Fig 1)

of the cervical canal, it is true, but because of the high percentage of stenosis produced with this electrode in the patients on whom it was used we have never gone back to it again. We have found that there is a much greater margin of freedom and safety with the unipolar "blunt needle" electrode. Falk also calls attention to the poor results of coagulation with the bipolar electrode.

TECHNIQUE

The treatment was limited to the electrocoagulation of cervical erosions with a spark gap machine. Other types of cervical lesions are rare and were weeded out in the other departments by smears, cultures, dark field, and biopsy before being referred for diathermy. The cases were not selected and except for certain definite but infrequent contraindications every type of erosion sent in was treated. These varied from the simple small erosions including the so called vaginal type to the extensive, raised erosions involving almost the entire cervix. These were often associated with lacerated edematous and hypertrophied cervixes and were complicated

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These facts prompt us to recommend this procedure to the gynecologist who is interested in securing colored records of cervixes which he may desire to demonstrate at a later date

SUMMARY

- 1 Electrocoagulation heals cervical erosion and stops the leucorrhea
- 2 It corrects the condition of sterility or decreased fertility associated with erosion
- 3 It permits a normal dilatation of the cervix at subsequent deliveries
- 4 Extension of inflammation to the trigone is to be suspected in those cases in which symptoms of frequency and nocturia are present.
- 5 Contra-indications to be kept in mind are pregnancy, acute cervical infection, and acute or subacute tubal involvement
- 6 Colored photography of the cervix is a valuable means of demonstrating cervical lesions and results of treatment.

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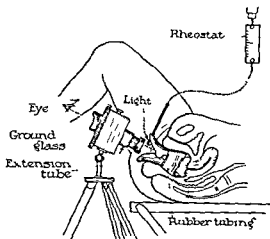


Fig 4 Diagram of equipment used in photography of the cervix

in labor go on to full dilatation as well as before coagulation. The following history of the senior author's (O Z B) last obstetrical case may be of interest:

Patient aged 25 years has 1 child 4 years old born in 1933. Patient has had discharge but no other symptoms since last delivery. Although she did not complain of sterility, both she and her husband used no contraceptives since delivery of last baby. The cervix was coagulated March 4, 1937, both lips and canal. Her menstruation ceased 8 weeks following coagulation. She delivered a 7 pound 8 ounce baby January 30, 1938. The first stage of labor lasted 3 hours, the second stage 1 hour. There were no lacerations of the cervix or perineum following delivery.

TECHNIQUE OF PHOTOGRAPHY

For the purpose of demonstrating our results, we tried to make photographic records of our cases. Black and white photographs failed in many ways to reproduce the lesion exactly even with the aid of panchromatic films and a yellow filter.

Colored photographs however reproduced the cervix perfectly, not only in perspective and detail but in color value and shading.

The main difficulty was in obtaining sufficient illumination on the cervix. This was accomplished by using a speculum with a single bright bronchoscopic light attached to one blade. The camera connected to a tripod by a ball and socket extension was placed flush against the opening of the speculum, the

light was directly in front, but not in the way of, the lens. (A two light arrangement, although very satisfactory for black and white prints, is unnecessary for colored photography because the colors in themselves produce the shading that is necessary to give the effect of depth.)

With this close focus arrangement, the speculum does not need to be blackened for prevention of reflection of light because no part of it is exposed to the lens (Fig 4).

The speculum is $4\frac{1}{2}$ inches long; therefore to bring the cervix into focus at this small focal distance, the lens must be lengthened by a 22 millimeter extension tube. This arrangement will bring the cervix into focus at exactly $4\frac{1}{2}$ inches.

A ground glass attachment may be connected to the camera and relieves one of the guess work of focusing. The image will then actually be seen and will become sharp when in focus.

We have tried and discontinued the tubular vaginal speculum early in our attempt to find an ideal speculum for photography. We found that only certain types of cervixes lend themselves to visualization with such a speculum and, besides its introduction was too painful for routine use.

The best results were obtained with an opening of F 6.3 to F 8.0 and an exposure of one second.

When developed, the colored pictures are actually colored transparencies. They easily lend themselves to projection in a lantern by being inserted between two glass slides.

Any small model camera with a ground glass attachment can be used in this work. In this instance, a Leica camera was used. Eastman Kodachrome films (18 exposures) gave a very exact color reproduction of the diseased tissue. This produces 35 millimeter pictures which can also be viewed through frosted (opal) glass lighted from the opposite side. Single exposure films did not allow the freedom of motion that the 18 exposure film did. For example, the operator may take a picture of the diseased cervix, coagulate, take another picture and coagulate again without leaving his seat in front of the patient and without changing the speculum.

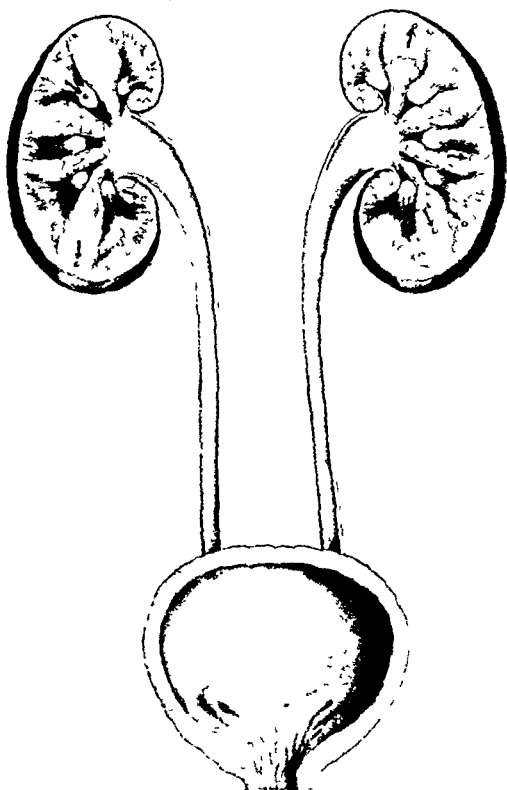


Fig 1 First stage of renal tuberculosis Metastatic tubercles in both kidneys Schematic

tuberculous renal lesion, and this accounts for the fact that most of the early tubercles are situated in the renal cortex. The finest ultimate branches of the renal artery are the vasa afferentia which supply the glomeruli, which are situated in the cortex. The medulla, however, is supplied mainly by the vasa efferentia which come from the glomeruli. Fine embolic particles containing tubercle bacilli will, therefore, have a tendency to lodge in the interlobular arteries, the vasa afferentia, or the glomerular capillaries. In other words they are caught in the finer arterioles and capillaries in the cortex before they might reach the medulla.

But Dehoff has described occasional communicating branches which run from the interlobular arteries, and from the vasa afferentia, to the capillary network in the medulla. Along this route, therefore, an occa-

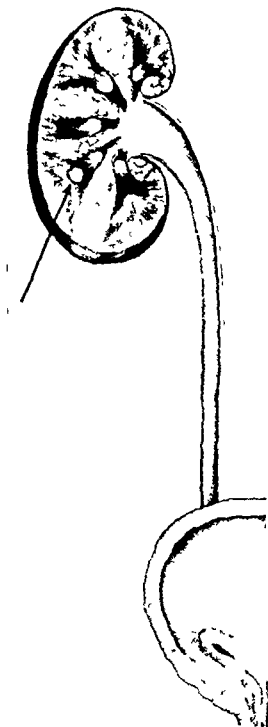


Fig 2 The tubercles have all healed except one in the medulla which has continued to grow Schematic

sional small embolic particle may find its way to the medulla to lodge there and give rise to the formation of a tubercle.

THE FIRST STAGE OF DEVELOPMENT— LATENT RENAL TUBERCULOSIS

But in spite of the difficulties which the tubercle bacillus finds in producing a renal lesion, metastatic tubercles appear in the kidney far more commonly than one might suppose. Medlar, with the aid of numerous histological sections of the kidneys of patients who had died of pulmonary tuberculosis, was able to demonstrate tubercles in over 60 per cent of the cases and in the majority of these the lesions were bilateral.

These foci are frequently so small that they are overlooked on routine postmortem examinations. They are usually situated in the cortex, but occasionally also in the medulla. They are frequently multiple and they have a tendency to heal (Fig 1).

RENAL TUBERCULOSIS

The Development of the Renal Lesion

FREDERICK LIFBERTHAL, M.D. Chicago Illinois

THE mention of renal tuberculosis usually calls to mind a kidney which is the seat of extensive destruction as a result of caseation and widespread cavitation. But the picture is not quite so simple, for the pathological changes which may occur in this disease are very complicated. A detailed knowledge of these changes is very important to the clinician for a proper understanding of the finer points in the diagnosis and operative therapy.

It is perhaps an error to speak of renal tuberculosis, for such a term suggests that the process remains limited to the kidney. Actually the disease advances relentlessly through the entire urinary tract once it has established itself. "Urinary tuberculosis" would, therefore, probably be the more proper term.

The first focus in the urinary tract is usually in the kidney. In this organ, too, the disease begins in a characteristic manner and advances through the renal tissue along certain definite pathways affecting certain selected parts of the renal architecture which are not involved in other disease processes. This lends the renal lesion in tuberculosis a unique character.

An attempt to reconstruct the development of the disease from the study of an isolated specimen is bound to lead one into error, for by virtue of its destructive nature tuberculosis obliterates the very pathways along which it has advanced. The perusal of the full blown lesion reveals a kidney which is discolored and perforated with numerous cavities with ragged walls, so that the organ is a mere ghost of its former self and gives no clue as to where the disease began and how it has developed. Subsequent histological study helps us very little, for the microscope reveals

only extensive caseation and necrosis, with only occasional areas in which scattered remnants of the previously normal tissue structure are evident.

If, however, one examines a large series of cases one soon finds that among them various specimens represent different stages in the development of the disease. By piecing together the various cases one is then able to reconstruct the development of the tuberculous renal lesion from its earliest to its end stages.

This is the plan of attack which we have followed in this study. Two hundred and seventy cases of renal tuberculosis were subjected to a combined clinical and pathological investigation. In addition postmortem studies and animal experiments were carried out to clear up certain problems which were not explained by an examination of the clinical cases.

THE SUSCEPTIBILITY OF THE KIDNEY TO TUBERCULOUS INFECTION

The tuberculous renal lesion is never primary but is practically always secondary to some previous focus elsewhere in the body, notably in the lungs. The kidney shows a peculiar immunity to infection by tubercle bacilli by virtue of its rich blood supply and the large caliber of the renal capillaries. Thus tubercle bacilli circulating in the blood are carried through the kidney to lodge in other organs. Only such circumstances which help the organisms to lodge in the kidney will favor the development of tuberculous lesions in that organ. Local disturbances in circulation, trauma, or the presence of the organisms in larger masses which produce emboli in the kidney (suspended in fat droplets in masses of debris or agglutinated masses of bacilli) may play a role.

Renal embolism, therefore, plays an important rôle in the production of the original

From the Department of Genito-urinary Surgery of the Northwestern University School of Medicine.
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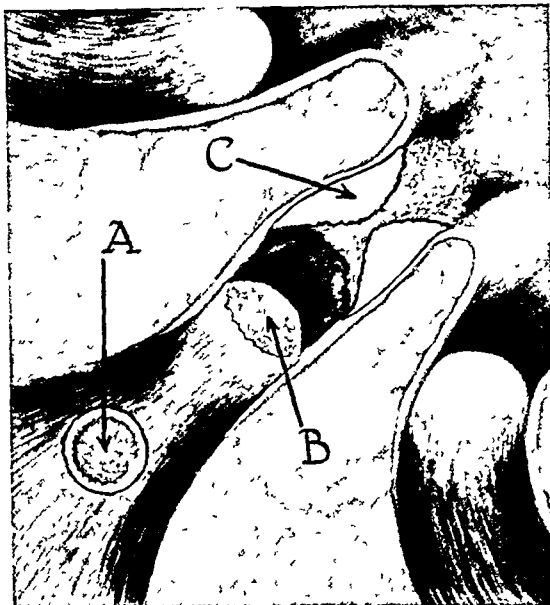
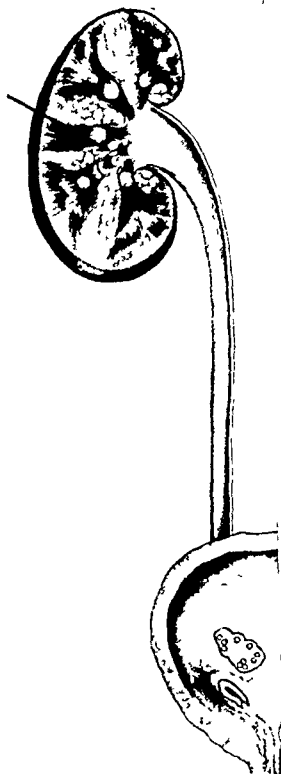


Fig 4b Magnified reproduction of detail in Figure 4a
A, Medullary tubercle, B, caseous papillary ulcer, C, tuberculous stricture of calyx Compare Figure 4c

Fig 4a Tubercle bacilli coming from the caseous center of the papillary ulcer have attacked the mucosa of the corresponding calyx, producing a tuberculous stricture of the latter (indicated by arrow) Compare Figure 4b Schematic

examination of this caseous center will usually reveal tubercle bacilli in tremendous numbers, whereas even the most extensive sectioning of tuberculous lesions in the renal substance itself will usually fail to reveal their presence. Because of these favorable conditions for the growth of the organisms in its center, such a papillary ulcer has a tendency to progress rather than to heal. The constant crumbling of the necrotic center leads to a prolonged dissemination of tubercle bacilli into the renal pelvis, as a result of which a descending infection of the urinary mucous membranes as well as an ascending reinfection of the previously uninvolved areas of the renal tissue takes place. *In other words, the papillary ulcer may be said to be the key lesion of renal tuberculosis.*

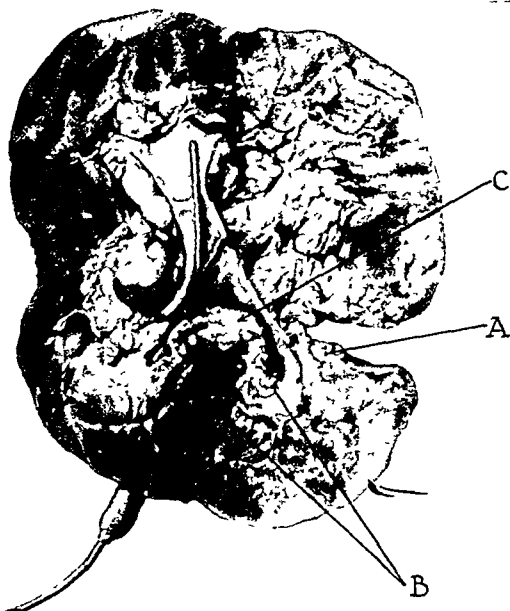


Fig 4c Incipient surgical renal tuberculosis A, Bean sized medullary tubercle, B, caseous ulcer on corresponding renal papilla, C, edematous tuberculous granulation tissue producing stricture of calyx Operative specimen



Fig. 3a. Incipient surgical renal tuberculous—caseous ulcer of an upper papilla. Operative specimen

Occasionally such a tubercle will continue to expand (Fig. 2). It may then break into a renal tubule and discharge tubercle bacilli into its lumen. The organisms are then carried along with the urinary stream in the tubule and will eventually either lodge somewhere along its course, there to produce a new lesion, or will be discharged into the renal pelvis.

A caseous ulcer may then form on the renal papilla by actual infection with organisms which are carried by the urine discharging over its surface, or by the perforation through its summit of an adjacent medullary tubercle (Fig. 3a and Fig. 3b).

THE SECOND STAGE OF DEVELOPMENT—THE FORMATION OF THE PAPILLARY ULCER AND DESCENDING INFECTION OF THE URINARY MUCOUS MEMBRANES

With the appearance of the caseous papillary ulcer we have the beginning of surgical renal tuberculous; for this is the first lesion which can be diagnosed clinically. Tuberculous lesions in the renal substance, which are not in open communication with the renal pelvis, do not disseminate tubercle bacilli into

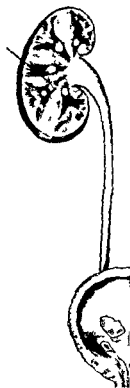


Fig. 3b. The corresponding renal papilla has become infected from the medullary tubercle and a caseous papillary ulcer has developed (indicated by arrow). Compare Figure 3a. Schematic.

the urine¹, they do not cause pyuria, and they do not produce a functional defect in the kidney. In other words they are latent lesions which are found only at autopsy. They have a tendency to heal rather than to progress. But as soon as the caseous papillary ulcer has appeared we have an open tuberculous focus from which tubercle bacilli find their way into the urine in the renal pelvis. The caseous center of such a papillary ulcer which is constantly bathed with urine forms an excellent culture medium upon which the tubercle bacilli grow luxuriantly. Histological

¹ Following the passage of a caseous medullary tubercle into a renal tubule, the tubercle bacilli may escape into the lumen of the tubule. They may then be washed into the renal pelvis with the urinary stream. But in the case of a caseous papillary ulcer, the tubercle bacilli are directly discharged into the renal pelvis. The caseous center of such a papillary ulcer which is constantly bathed with urine forms an excellent culture medium upon which the tubercle bacilli grow luxuriantly. Histological

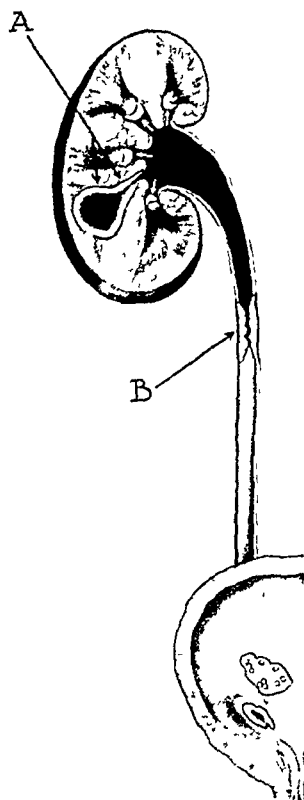


Fig 6a The tuberculous urine pouring into the renal pelvis from the cavity at A has led to the production of tuberculous mucous membrane lesions which have given rise to the formation of a tuberculous stricture of the ureter at B. The tuberculous urine subsequently stagnating in the pelvis behind the stricture has attacked the remaining renal papillae (indicated by arrows). Compare Figure 6b Schematic.

THE URETERAL LESION

In the ureter these changes soon produce a serious functional disturbance. Because of the narrow lumen of that organ even a small mucosal granulation will begin to produce obstruction (Fig 6a and Fig 6b). Such a lesion also has the tendency soon to encircle the lumen, and with the spread of the process into the deeper layers and the resulting reactive edema and round cell infiltration, a definite obstruction develops (tuberculous stricture).

The muscle fibers of that portion of the ureter which is situated above the point of the obstruction then undergo a hypertrophy

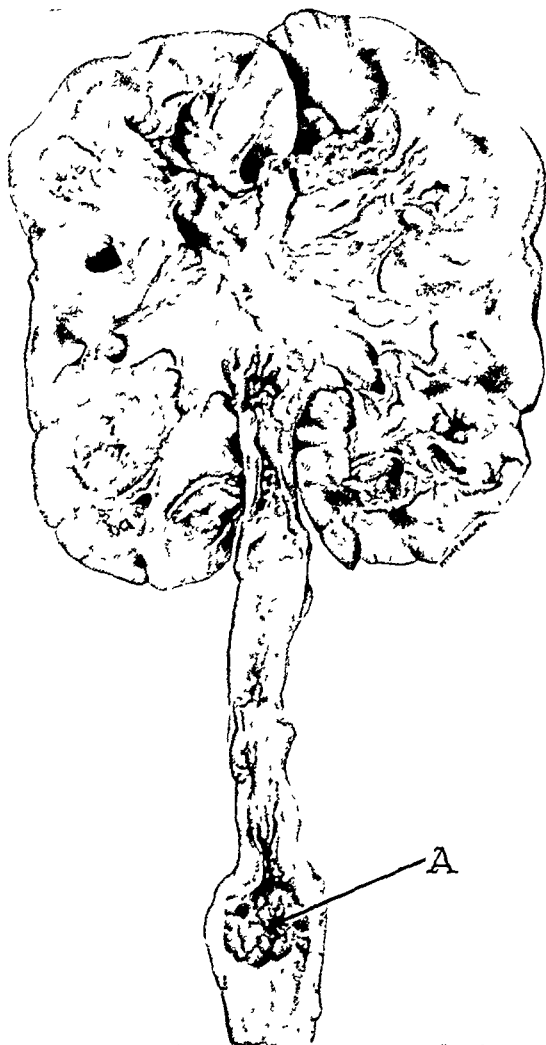


Fig 6b Tuberculous granulations on the pelvic and ureteral mucosa. Large occluding ureteral granuloma at A. Tuberculous granulations are forming on the renal papillae. Operative specimen.

to enable the ureteral peristalsis to drive the urine through the obstruction. Eventually the tuberculous process involves the ureter throughout its entire length and the latter is transformed into a thickened, rigid, shortened, immobile tube in which signs of peristalsis are no longer evident because of a paralysis of the muscle fibers. This is the picture which is characteristic of so called *concentric hypertrophy of the ureter*.



Fig 5a. The stagnation of tuberculous urine behind the stricture (indicated by arrow) has led to the formation of a cavity through the combined action of tuberculous erosion and hydronephrotic atrophy. Compare Figure 5b. Schematic

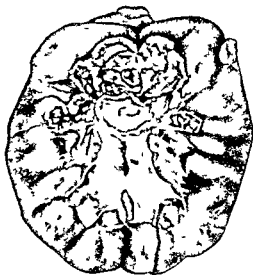


Fig 5b. Walnut sized caseous cavity behind tuberculous stricture of upper calyx (indicated by arrow). Operative specimen

which no signs of inflammatory change are evident

Eventually the tubercles in the granulation caseate and break down to form tuberculous ulcers with ragged knife like, undermined edges. The base of such an ulcer is not infrequently found to be covered with a dirty, grayish deposit.

The mucous membranes of the calyces, of the renal pelvis, of the ureter of the urinary bladder and less frequently those of the urethra may be so affected. At first the process remains limited to the epithelial layer, but gradually it advances into the sub-epithelial and muscular layers. This extension of the degenerative process is accompanied by a reactive edema and a round cell infiltration and it gives rise to an induration of the affected tissues. The smooth muscle fibers also begin to demonstrate degenerative changes. Vacuolization of the muscle fibers is not infrequently seen.

The progress of the caseation and the confluence of the numerous tuberculous ulcers eventually gives the mucosal surface a dirty grayish ragged moth eaten appearance as was found in the specimen shown in Figure 5b.

THE MUCOUS MEMBRANE LESION

The urinary mucous membranes are very susceptible to infection by the tuberculous urine flowing over their surface. The lesions appear first as isolated tubercles in the form of small pinhead to larger, yellowish, raised, opaque nodules, which bulge from the epithelial layer and are surrounded by a small reddened zone. Gradually, as the lesion spreads, the typical tuberculous mucosal granulation appears, in the form of a pea sized to larger plaque, which is brownish red in color, in which the mucosa seems to be roughened and loosened from the underlying tissue, and which is studded with small yellowish tubercles. These affected areas are found to be sharply circumscribed and they are surrounded by a normal mucous membrane in

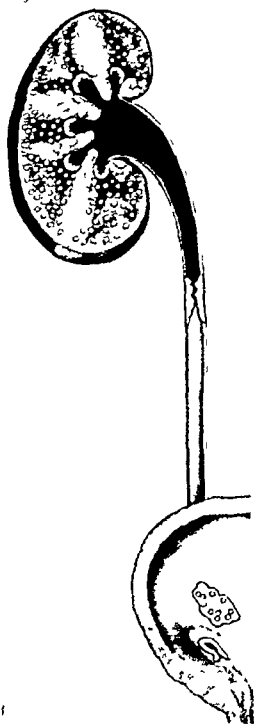


Fig 8a Disseminated wedges extending from caseous ulcers of all of the renal papillae. Such a picture is uncommon and is the result merely of a chance simultaneous erosion of the collar arteries of the various papillae. Compare Figure 8b. Schematic.



Fig 8b Disseminated nodular form of renal tuberculosis (Wildbolz). Operative specimen.

As a result of the obstruction caused by tuberculous involvement of the ureter, the tuberculous urine has a tendency to stagnate in the renal pelvis and so remains in prolonged contact with the mucous membranes of the pelvis and with the previously uninvolved renal papillae. The latter then become infected (Fig 6a and Fig 6b).

THE THIRD STAGE OF DEVELOPMENT— ASCENDING REINFECTION OF THE KIDNEY

At first isolated tubercles and gradually tuberculous granulations similar to those seen upon the urinary mucous membranes appear upon the summit of each infected papilla. Occasionally a reactive edema develops, so that the papilla becomes swollen and has the gross appearance of a small papilloma. Eventually caseation occurs and a papillary ulcer forms (Fig 7a and Fig 7b). As the

caseous erosion progresses deeper into the renal tissue a smaller renal artery is eroded and tubercle bacilli are disseminated through that area of renal tissue supplied by the vessel. The resulting infection of the renal substance leads to the formation of chains of tubercles which extend in radial fashion from the point of erosion to the surface of the kidney (Fig 7a and Fig 7c). A favorite location for such an erosion is in the pericalycal fat just lateral to the calycopapillary niche. At this point a branch of the renal artery, from which the interlobar arteries take their origin, is to be found coursing around the periphery of the papilla.

As the tuberculous process in the ureter advances, the obstruction of the lumen becomes progressively more marked. The stagnation of the urine in the renal pelvis gradually advances to a state of actual back pressure. The original caseous erosion of each renal papilla has progressed to the formation of a cherry to walnut sized cavity. The tuberculous process has spread over the mucous membranes of the calyces and pelvis which are now the seat of widespread caseation and ulcera-



Fig 7a The tuberculous lesions on the renal papillae have progressed to the formation of caseous papillary ulcers (indicated by arrows) Compare Figure 7b The erosion of one upper renal papilla has extended into the lumen of an artery leading to the dissemination of tubercle bacilli through the area of tissue supplied by the vessel with the resulting formation of a disseminated wedge of tubercles Compare Figure 7c Schematic

TUBERCULOUS STRICTURES AND URINARY STASIS—THEIR RÔLE IN THE SPREAD OF THE RENAL LESION

Tubercle bacilli coming from the caseous center of a papillary ulcer may attack the mucosa of the corresponding calyx and gradually lead to a tuberculous stricture of the latter (Fig 4a Fig 4b and Fig 4c) The urine which pours out over the summit of the tuberculous papilla and which as a result becomes richly laden with tubercle bacilli from the caseous center of the ulcer, stagnates in back of the stricture and finds an ideal opportunity to attack the corresponding medullary pyramid This rapidly leads to the development of a tuberculous cavity through the combination of hydronephrotic change and tuberculous erosion (Fig 5a and Fig 5b)

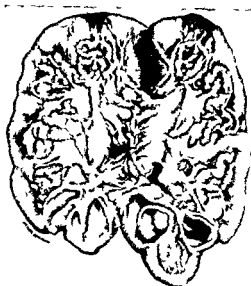


Fig 7b Multiple caseous ulcers of the renal papillae High grade tuberculous occlusion of the ureter (not shown) Operative specimen

This sequence of pathological change explains the 'clover leaf calyces' so often seen in pyelographic studies of tuberculous kidneys

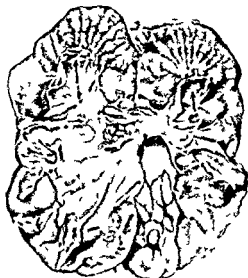


Fig 7c Disseminated wedge of tubercles extending through the renal substance from a caseous ulcer of an upper renal papilla Operative specimen

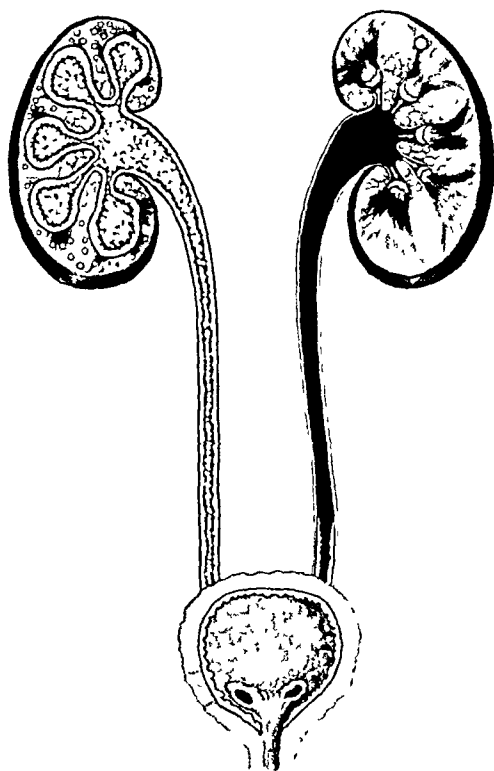


Fig 10a The contents of the right renal pelvis and ureter have become inspissated and converted into a thick mortar-like substance. Compare Figure 10b. The papillae of the left kidney have become infected through a reflux of tuberculous urine up the ureter. In the cortex of the left kidney a metastatic tubercle. Schematic

Occasionally the mucous membrane lesion dominates the pathological picture in renal tuberculosis. It has been shown that, as a result of the production of the primary lesion in the body, a sensitization may occur. The onset of a secondary, metastatic lesion may then be greeted by a violent local reaction of the tissues involved, which manifests itself in an exaggerated inflammatory or exudative phase. Since caseation depends upon the exudative phase and tubercle formation upon the subsequent productive phase, the formation of a metastatic focus in sensitized patients results in extensive tissue destruction and caseation. Histologically such a lesion will show wide necrosis. Well defined tubercles with typical Langhans' giant cells may be only sparingly present or even totally absent.

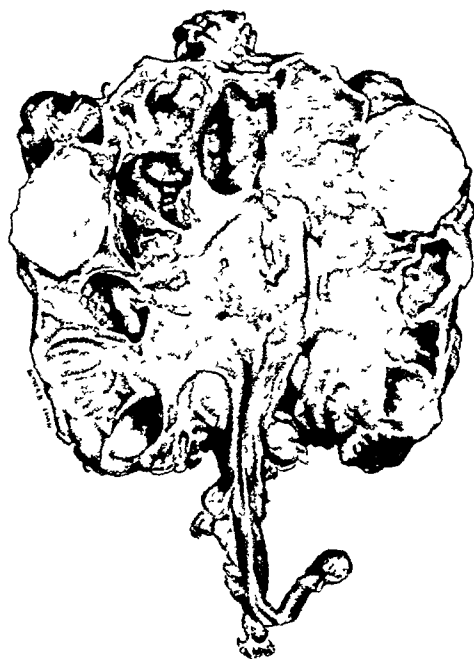


Fig 10b Mortar kidney. Most of the caseous debris has been removed to show the resemblance of the remaining shell to that of a hydronephrosis. Operative specimen.

When this occurs in the kidney the perforation of the tuberculous process into the lumen of the renal pelvis is followed by the appearance of a lesion which spreads like wild-fire over the mucosa of the pelvis, of the calyces and of the ureter, producing the picture of caseous pyelo-ureteritis (Fig 12).

INVOLVEMENT OF THE SECOND KIDNEY

A By way of the blood stream Early in the course of development of a renal tuberculosis, small isolated tubercles appear in the opposite kidney. These are the result of a blood stream metastasis and they are usually situated in the cortex. They are latent lesions and they are not demonstrable clinically. They are found only at an autopsy upon patients who have died following a nephrectomy for renal tuberculosis. *It has, therefore, been said that renal tuberculosis is usually clinically unilateral and pathologically bilateral* (Fig 10a).

B Ascending infection by way of the urinary passages The opposite kidney may, however, and usually is, finally involved by an ascend-

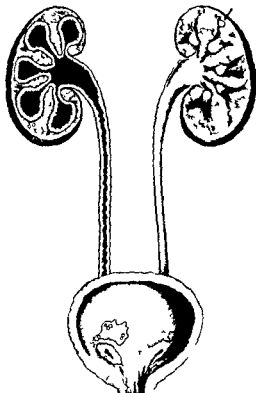


Fig 9a The tuberculous process has spread through the various layers of the renal pelvis and ureter. The original caseous erosion of each renal papilla has progressed to the formation of a cherry to walnut sized cavity. Compare Figure 9b. Schematic



Fig 9b Caseovascular renal tuberculosis. Operative specimen

tion (Fig 9a and Fig 9b). Eventually the stagnant tuberculous urine in the pelvis and in the cavities in the renal substance becomes inspissated and converted into a thick mortar like substance (mortar kidney). The kidney has now been transformed into a mere shell with thin walled partitions extending between the cavities. These on careful gross sectioning are seen to correspond to the columns of Bertini (Fig 10a and Fig 10b).

The back pressure and stagnation of urine resulting from tuberculous stricture of the calyces and ureter also render the kidney susceptible to secondary infection. The pathological changes of a pyelonephritis and eventually those of a pyonephrosis may then be superimposed upon those of tuberculosis giving rise to the picture of tuberculous pyonephrosis.

(Fig 11) Tuberculous kidneys are notably free from a sclerosis of the peripelvic and perirenal fat tissue. Hence, nephrectomy is a comparatively simple procedure in most cases of renal tuberculosis. But in the presence of secondary infection and a resultant tuberculous pyonephrosis, extensive peripelvic and perirenal fibrolipomatosis may occur.

In some cases the obstruction due to the narrowing of the tuberculous stricture may occur so rapidly that the ensuing back pressure of urine and consequent hydronephrosis may develop so suddenly as completely to outstrip and overshadow the accompanying slowly developing tuberculous process. The resulting renal lesion may then have the gross appearance of a hydronephrosis rather than of a tuberculosis and the latter becomes evident only on histological study. Only a portion of the kidney may be so affected (due to a calyceal stricture) or the entire organ may undergo hydronephrotic change (due to a ureteral stricture).

If a complicating secondary infection appears early in such a case a non tuberculous pyonephrosis may rapidly develop and completely overshadow the small tuberculous renal lesion which was the original cause of the ensuing pathology.

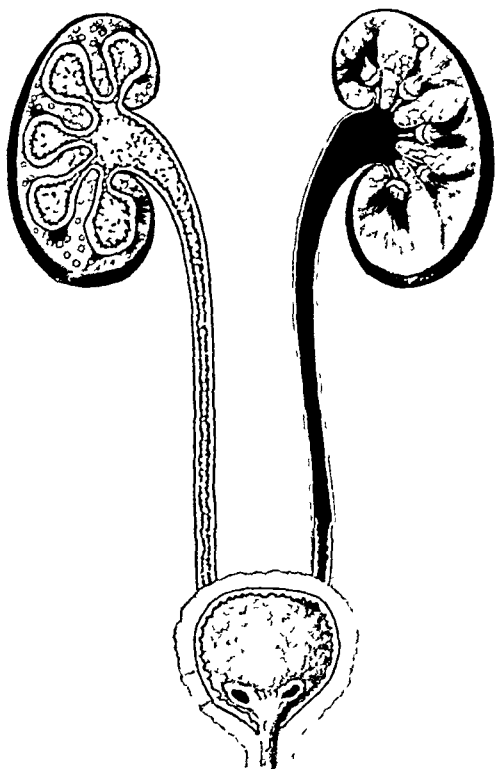


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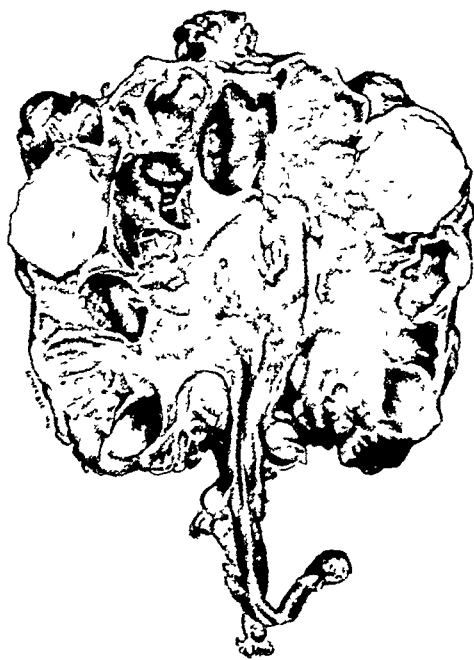


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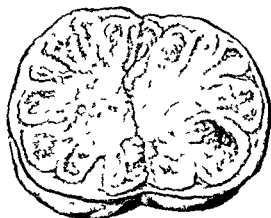


Fig. 11 Tuberculous pyonephrosis. Considerable peripelvic fibrolipomatosis (replacement lipomatosis) is present. Operative specimen.

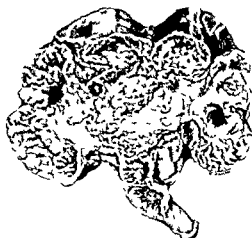


Fig. 12 Caseous pyelitis. Operative specimen.

ing infection in cases in which operation is not done.

Soon after the appearance of the original papillary ulcer tuberculous lesions begin to appear in the bladder as well as on the mucous membranes of the upper urinary passages. At first there is merely a bullous edema of the ureter orifice on the involved side. Soon typical granulations begin to appear in its vicinity. As the discharge of tubercle bacilli from the diseased kidney continues the granulations increase in number and spread over the surface of the bladder mucosa until they involve the opposite ureter orifice and begin to ascend along the mucosa of the opposite ureter. The involvement of the opposite ureter orifice in the tuberculous process soon leads to an incompetence of its sphincter. Then in its painful and spasmodic attempts to expel its contents the bladder pumps tuberculous urine up into the opposite renal pelvis, and infection of the second kidney rapidly follows (Fig. 10a).

SUMMARY

1 The kidney shows a peculiar immunity to tuberculous infection by virtue of its rich blood supply and the large caliber of its capillaries. Hematogenous tuberculous infection of that organ becomes possible through the medium of embolism.

2 The initial lesions are situated mainly in the cortex and are usually bilateral.

3 In the spread of the tuberculous lesion through the kidney three definite stages are evident. In the first stage metastatic tubercles appear in the renal substance. In the second stage a caseous ulcer appears on a renal papilla and a descending infection of the urinary mucous membranes follows. In the third stage an ascending reinfection of the previously uninvolved portions of the renal tissue occurs.

4 In this ascending reinfection of the renal tissue the arterial system of the kidney plays a leading rôle.

5 Tuberculous strictures of the ureter and of individual calyces lead to a stasis of tuberculous urine, which plays a leading rôle in the maintenance and spread of the tuberculous process through the kidney.

6 This stasis also gives rise to hydro-nephrotic changes which go hand in hand with tuberculous erosion to cause destruction of renal tissue.

7 Tuberculous lesions in the kidney have a tendency to heal, but as soon as the process breaks into, and communicates with the lumen of the renal pelvis peculiar conditions are produced which counteract this tendency to heal.

8 Tuberculous lesions in the first stage are latent and cannot be diagnosed clinically. In the second and third stages they can be so diagnosed

9 Secondary non-tuberculous changes which alter the final pathological picture may occur in cases of renal tuberculosis.

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NON-ROUTINE VIEWS IN ROENTGEN EXAMINATION OF THE EXTREMITIES

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THAT the commonly employed roentgen examination of extremities is often inadequate and insufficient to reveal the existing pathological process, or to give complete information concerning the pathological condition shown is a well

known fact. It is with the purpose of emphasizing this fact and of calling attention to simple and useful methods of supplementing the usual procedures that this paper is written. No claim to originality is made in any of the methods herein described. They have been collected in hospital and office practice over a period of years, to whom credit is due for their inception, I do not know.

From the Department of Roentgenology, Hospital for Ruptured and Crippled.

Examinations of the shoulder and upper third of the humerus as usually carried out, especially if the arm is in a Velpau or sling in internal rotation, are particularly inadequate. The average examiner seems to feel that he is hopelessly handicapped from the start by the immobilization and that the maximum he can accomplish is a pair of stereoscopic films in antero-posterior projection, with the arm in internal rotation.

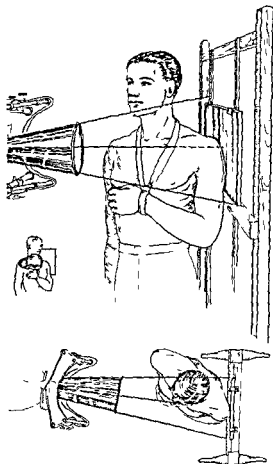


Fig. 1. Methods of making oblique projections of the shoulder when arm is fixed in internal rotation. This is the equivalent of examination in external rotation and shows the tuberosities well.

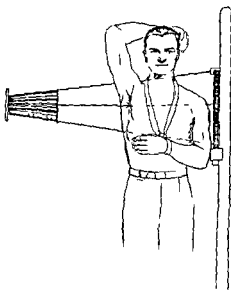
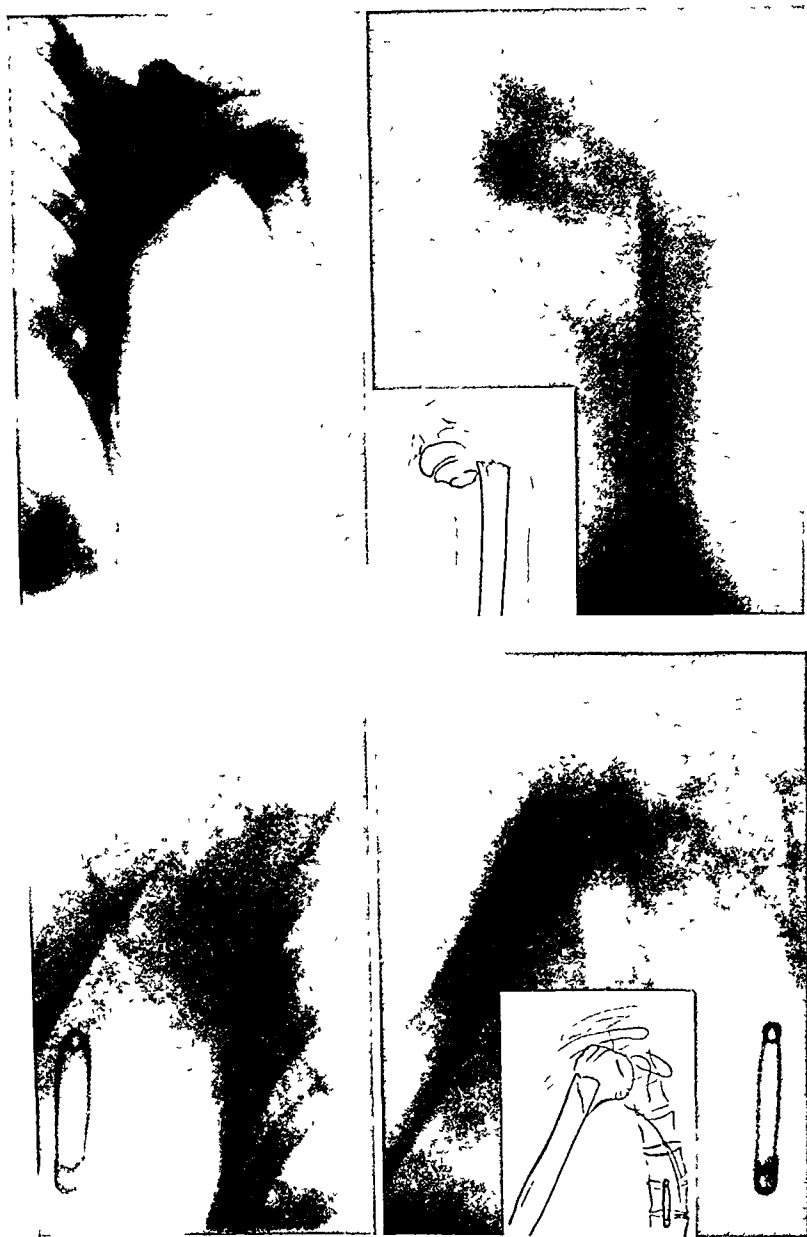
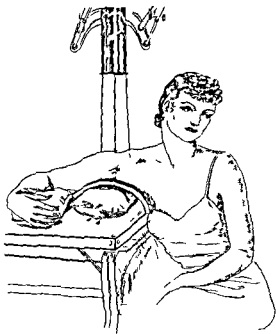


Fig. 2. Method of obtaining a lateral projection of the shoulder. The position is such as to project the shoulder between the spine and sternum. It shows antero-posterior displacement accurately. See Figures 3 and 4.

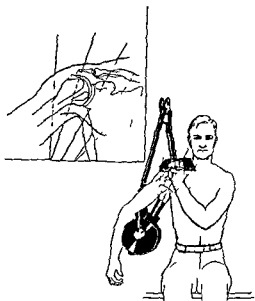


Figs 3 and 4 Anteroposterior and lateral views of shoulders Lateral projections made as shown in Figure 2, above They give accurate information with regard to anteroposterior displacements

No stereoscopic films of an extremity in one plane are as satisfactory as an examination consisting of clear plane films from numerous different angles And such study of a shoulder in a sling or Velpeau can be readily carried out by examining the patient in erect position, standing or sitting, and rotating the patient's body, rather than the shoulder, to get the de-



Figs 5 and 6 Methods of getting the shoulder in vertical projection Figure 5 with curved cassette, Figure 6 with



shock proof dental or portable unit. The second method is applicable to shoulders without abduction See Figure 7

sired projections of the shoulder Figure 1 shows the oblique position which projects the humerus in a position of external rotation Figure 2 illustrates the lateral position In the latter by proper positioning, the



Fig 7 Vertical projection of shoulder taken as shown in Figures 5 and 6 Shows an os acromiale as described by Liberson

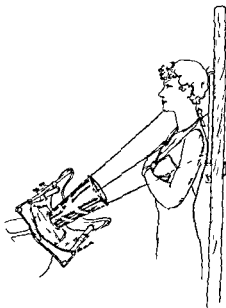


Fig 8 Method of making an oblique view of the clavicle See Figures 9 and 10



Fig 9 Anteroposterior and oblique projections of the clavicle The latter made as illustrated in Figure 8 The oblique view shows clearly a fracture not recognized in the anteroposterior film



Fig 10 Anteroposterior and oblique views of the clavicle The oblique projection gives additional information as to position and repair This view is also useful in showing fractures of the acromion

upper extremity of the humerus is seen through the thorax, projected between the spine and sternum, where its visibility is fairly good Figures 3 and 4 show the value of these lateral films

When the arm is not immobilized, a very valuable projection is the vertical Figures 5 and 6 show methods of obtaining this view When abduction is difficult because of physical disabilities, the procedure with a dental unit or shock proof portable equipment, as shown in Figure 6, can usually be carried out without difficulty Figure 7 shows such a projection Unsuspected fractures of the acromion process are frequently found by this examination The coracoid process and outer end of the clavicle are clearly visualized, and calcareous deposits about the upper extremity of the humerus can be frequently localized with accuracy Other valuable projections of the shoulder have been recently described by Blackett and Healy

Anteroposterior projections of the clavicle often give erroneous information, and incomplete data as to displacements and degrees of repair Figure 8 shows how to make a valu-

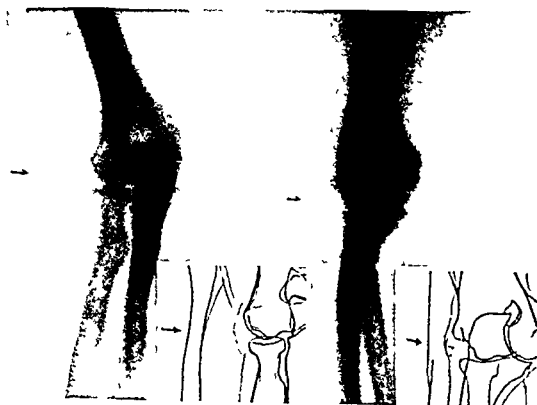


Fig 11 Oblique views of the elbow, showing deposits which were scarcely visible in routine anteroposterior and lateral films.

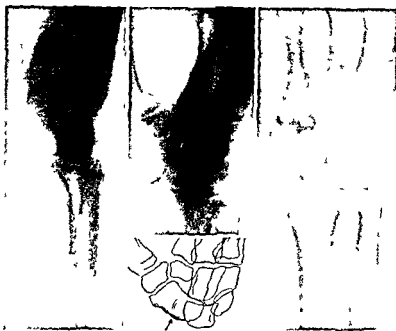


Fig. 12. Fracture of acromion showing clearly in oblique projection. Might well be missed without this view.

able supplementary oblique view, and Figures 9 and 10 show the additional data supplied by this projection. Fractures of the acromion are also usually shown clearly in films taken at this angle.

To detect acromioclavicular separations it is highly desirable to examine the patient erect, and which is most important with the extremity unsupported. In this way the separation will manifest itself as a change in the

horizontal relationships of the adjacent extremities of the acromion and clavicle. The acromion will lie on a lower level than the clavicle. In this study the inferior surfaces of the extremities are more reliable guides than the superior, as the latter are frequently not on the same level normally. Of course the opposite shoulder may be used for comparison.

Oblique projections of the elbow are very valuable in showing calcareous deposits which are frequently not shown in the routine anteroposterior and lateral views. An oblique view tangential to the posterior surface of the lateral humeral epicondyle is especially useful in visualizing the small deposit in epicondylitis humeri. Figure 11 shows deposits which were scarcely visible in routine films.

Lateral views of the elbow in flexion and extension are useful in determining whether small calcifications sometimes seen near the upper anterior margin of the olecranon process and elsewhere are attached to the bone, or are free within the joint. Also these views, when permitted, will determine the potential degree of separation and approximation of the

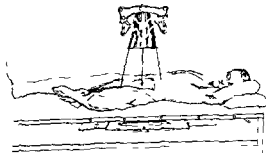


Fig. 13. Simple procedure in taking a lateral of the hip when flexion and rotation are present. See Figure 14.

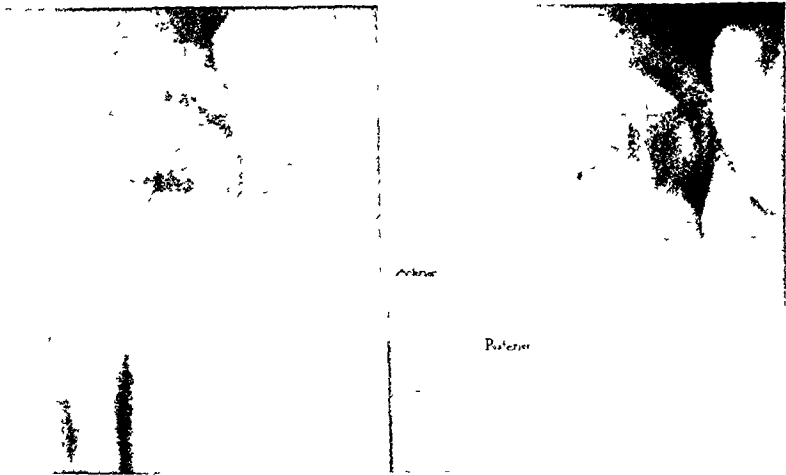


Fig 14 Anteroposterior and lateral views of the hip, the lateral made as in Figure 13 The lateral shows the degree of posterior displacement of the femoral head

fragments of a recent fracture of the olecranon process Similarly, they will give information with regard to the degree of bony or fibrous union in such a fracture after treatment

In old fractures about the elbow, with limitation in flexion and extension, lateral films in maximum flexion and extension will give important information with regard to the presence or absence of bony block This also applies to the ankle

No examination of the wrist should be limited to anteroposterior and lateral views Many fractures of the scaphoid, and some fractures of other carpal bones, will not be visible in these films An oblique projection, half way between pronation and true lateral,

should always be included (Fig 12) Often, in difficult cases, the oblique half way between supination and true lateral is helpful

Attention is again called to the necessity of vertical (lateral) views of the hip, as originally introduced by Dr. George, in fractures and displaced femoral capital epiphyses These may be made either with the x-ray tube above and laterally, and a curved cassette between the thighs; or by a shock proof tube between the thighs and a straight cassette against the lateral side of the body

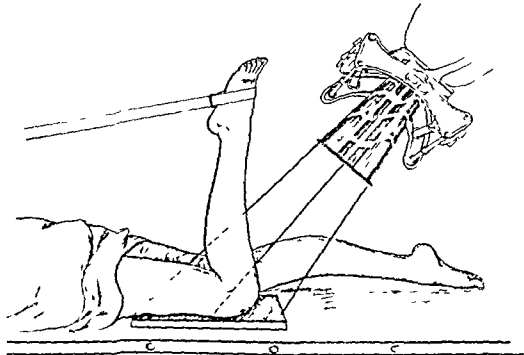


Fig 15 Method of making a vertical projection of the patella See Figure 16



Fig 16. Vertical and oblique projections of the patella, showing vertical fracture Useful also in visualizing separate ossification centers, loose bodies in the joint, and in studying the shape of the anterior surface of the lower extremity of the femur



Fig. 17 Oblique view of the ankle in 45 degrees internal rotation. Shows vertical fissure fracture in calcaneus not shown in any other projection.

In hip cases in which flexion and lateral rotation are possible, lateral projections can be made quite easily as indicated in Figure 13. Figure 14 shows films made in this way.

In examining acute injuries of the hip, a common error in technique is making films in external rotation or in any other position in which the extremity may happen to be lying. This is often done even though it is a well known fact that the femoral neck is very



Fig. 18 Oblique view of the ankle in 45 degrees internal rotation. Shows fracture of sustentaculum tali. Note how well the lower tibiofibular mortise is shown.

inadequately visualized except in neutral position (with the foot directed straight forward), or better yet, in internal rotation. In most of these injury cases it is possible to obtain a neutral position by gentle manipulation and the examination should be made in this position.

Similarly, in examining these cases later for union or lack of union the extremity should be examined in internal rotation. Also when permissible, views in internal rotation should be taken in adduction and abduction and with push and pull on the extremity. These

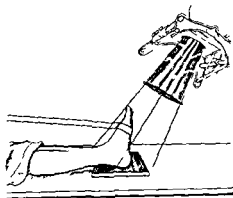


Fig. 19 Method of showing tuberosity of calcaneus in oblique projection. Useful for visualizing fissure fractures, and determining gross deformity in comminuted fractures.

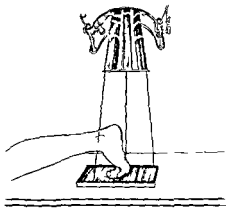


Fig. 20 Method of showing sesamoid bones under the first metatarsal head and of viewing plantar surfaces of the metatarsal heads. See Figures 21 and 22.



Fig 21, left Fracture of the sesamoid bone shown by method illustrated in Figure

20

Fig 22 Pathology of sesamoid bone shown by method illustrated in Figure 20

films should be studied for evidence of change of relationship of the fragments to each other

It would seem that the routine antero-posterior views of the knee could be replaced advantageously by postero-anterior projections. These latter give as complete information concerning the joint as a whole, and have the following added advantages: they show the patella more clearly, due to its closer proximity to the film, and they give less distortion in knees lacking complete extension.

Figure 15 illustrates a well known and commonly used method of visualizing the patella. This is valuable in showing vertical fractures, in differentiating fractures from ununited separate ossification centers of the patella, and in showing such pathological conditions of the patella as osteochondritis dissecans. This projection also visualizes the anterior surface of the lower extremity of the femur, and assists in determining whether there is an anatomical factor in recurrent dislocation of the patella. Oblique views of the knee are also useful (Fig 16).

Holmblad has recently described another valuable method of examining the knee.

Of equal importance with the oblique projection of the wrist is the oblique view of the ankle. This is taken in about 45 degrees' internal rotation, and it is important that the ankle be rotated inward and not just the foot. This view shows the lower tibiofibular articulation unusually well, and is of importance

in establishing the diagnosis of separation of the lower tibiofibular mortise. It frequently shows fractures of the tibia, fibula, astragalus, and calcaneus, which are not visible in the other projections (Figs 17 and 18), and shows tearing of ligaments evidenced by avulsed spicules of bone.

Another well known non-routine view of the calcaneus is illustrated by Figure 19. This is useful in showing fissure fractures, and in determining the extent of gross deformity in comminuted fractures.

A useful procedure in studying the sesamoid bones under the first metatarsal head, and in viewing the plantar surfaces of the metatarsal heads, is depicted in Figure 20. This gives information on fractures (Fig 21) and other pathological conditions (Fig 22) of the sesamoids.

In examining forefeet for possible etiology in cases of plantar wart or tender callus, a small metal marker strapped with adhesive on the wart or callus gives helpful information with regard to the relationship of the lesion to the sesamoids, or to any underlying bony protuberances or exostoses.

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FERTILITY AND STERILITY AFTER EXTRA-UTERINE PREGNANCY

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EXTRA-UTERINE pregnancy is one of the dangers every woman has to face between puberty and the menopause. Since, according to the statistics of Schumann, one extra uterine pregnancy occurs in every 300 pregnancies, it is not less common than twin pregnancies. The often unexpected change from complete health to the development of the most alarming symptoms and sometimes death in cases of extra uterine pregnancy stimulated physicians to study its causes and to improve methods of diagnosis and treatment. The treatment of ectopic pregnancies then became one of the most successful fields of modern surgery.

It is a well known fact that ectopic pregnancies have the tendency to recur on the opposite side. Women who have already had an extra uterine pregnancy are about ten times more likely to have a recurrence in the other side than those who have never had an ectopic pregnancy. The conditions for developing tubal pregnancy are usually more or less the same in both tubes. The question therefore is whether it is worthwhile to save the other tube in cases of ectopic pregnancy.

It is a generally accepted principle in treating ectopic pregnancies surgically to make the operation as conservative as possible. The idea, of course is to preserve the possibility of later normal pregnancies even though there is a chance of a subsequent ectopic gestation. A great number of papers have been published on ectopic pregnancy studies being based on collected cases as well as on detailed reports of single observations especially in cases of recurrent ectopic pregnancy. All such papers give the findings at operation and the history, but few take into consideration what happened to the patients later, especially concerning the question of subsequent pregnancies. In the present study therefore a method

of follow up was used which was designed to show what actually happened subsequently to patients with ectopic pregnancies. This paper therefore concerns what type of operation is preferable in cases of ectopic pregnancy, and how many and what kind of subsequent pregnancies occurred in a given period.

In 1917, Masson and Simon reviewed a series of cases in which patients had been operated upon for ectopic pregnancy at The Mayo Clinic from 1903 to 1926. There were 437 patients in this series, 445 operations having been performed for ectopic pregnancy. In 198 cases in which it was theoretically possible for the patient to have become pregnant later, the data indicated that 87 (44 per cent) had become pregnant, the 111 remaining (56 per cent) had not been pregnant when last heard from. One hundred sixty two pregnancies occurred in those 87 cases, 110 of which were normal and 34 of which eventuated in miscarriage. 18 were extra uterine pregnancies. The present study is concerned with patients operated on for ectopic pregnancy at the clinic during the 10-year period from 1926 to 1935. While 15 cases for the year 1926 were included in the study by Masson and Simon, we thought it better to include them in our study also since the shortness of the time interval between operation and the publication of their paper precluded the possibility of further pregnancies in this group of cases.

In going through the histories of these patients who had been at the clinic during this 10-year period we encountered some factors and problems besides the question of subsequent normal pregnancies and subsequent ectopic pregnancies which seemed worthy of study. Aside from the mortality which always has to be given first consideration in any report of this nature, the question of sterility and fertility after extra uterine pregnancy seemed to be of greatest importance.

From January 1, 1926, to December 31, 1935, 142 patients with ectopic pregnancies were seen at the clinic. One hundred forty-one of these patients were operated on, and there were no deaths in the series. The other patient came to the hospital in shock and died before operation was possible. The total mortality for the series was accordingly 0.7 per cent, the surgical mortality zero. When a higher mortality than this is reported in the literature, it is very often because of delay in seeking surgical treatment (many patients in other series being colored patients) and inability for one reason or another to resort to blood transfusion when indicated. Transfusion is frequently a life-saving measure in these cases and autotransfusion has occasionally been practiced successfully. Fitzgerald and Brewer, for example, reported 500 cases of extra-uterine pregnancy with a total mortality of 7 per cent. They attributed this mortality to the fact that there were inadequate means of obtaining blood transfusions except from relatives. Twelve of their patients died without operation and without transfusion, 23 died after the operation, but only 3 of them had received a blood transfusion. In Table I is given the total mortalities for series containing more than 100 cases.

While the number of patients with ectopic pregnancies seen at the clinic in this period of 10 years seems rather small, it must be remembered that extra-uterine pregnancy is usually an emergency affair and, as a result, patients see the nearest doctor or go to the nearest hospital. The patients in this series, therefore, were mostly those who lived in the immediate vicinity of Rochester.

In one case in this series, the pregnancy was abdominal. The patient, who was 37 years old, had had 3 previous normal pregnancies and had undergone appendectomy. At exploration, the ovum was found in the cul-de-sac and it was removed. One blood vessel had to be ligated behind the right sacro-uterine ligament. The very fact that there were not more changes and attachments in the cul-de-sac by the implantation of the ovum makes it rather certain that this case of ovarian pregnancy belongs to the group of secondary abdominal pregnancies. The ovum

TABLE I—TOTAL MORTALITY IN EXTRA-UTERINE PREGNANCIES

Author	Cases	Deaths	Per cent
Tyrone, Romano, and Collins	309	36	11.6
Falk and Rosenbloom	313	26	8.3
Davidow	218	17	7.7
Fitzgerald and Brewer	500	35	7
P. Brooke Bland (collected cases, quoted by Ludwig)	703	33	5
Bamberger	150	5	3.3
Urdan	474	14	2.95
D. B. Ludwig	145	3	2
Behney	147	3	2.04
Mayo and Strassmann	142	1	0.7
Total	3101	173	5.5

had been primarily located in the ampulla of one fallopian tube, and had subsequently developed or dropped into the abdominal cavity (tubal abortion). At the time of the operation, however, it was entirely separated from the tubes, so that there was no reason to remove either a tube or an ovary. It was not possible even to tell which tube had been involved. This is a common finding in abdominal pregnancy. The ovum is seldom located in the peritoneal cavity or other organs besides the ovary or fallopian tubes. This patient subsequently became pregnant 8 months after the laparotomy, and on dilatation and curettage a hydatidiform mole was removed.

In another case, that of a 19 year old patient with an ovarian pregnancy, a ruptured hemorrhagic cyst was found in the right ovary. Microscopically this showed placental tissue. The right tube was altered by chronic salpingitis, and it and the ovary were removed. This patient became pregnant about 3 years later and gave birth spontaneously to a living child.

In the 140 remaining cases in this series pregnancy was tubal, in 77 cases (55 per cent) the right tube being involved, in 63 cases (45 per cent) the left.

It has been stated by various investigators that ectopic pregnancies occur more often on the right side than on the left. The percentage, however, varies. Bamberger, for example, in 150 cases of ectopic pregnancy found 78 in the right tube, 72 in the left. Tyrone, Romano, and

Collins, in 258 cases found 62.4 per cent in the right tube, 37.6 per cent in the left. It is hard to tell in a given case why the ectopic pregnancy occurred on one side instead of on the other. The most important etiological factor in ectopic pregnancy in so far as the genital organs themselves are concerned, is chronic infection which involves both tubes more or less equally. Salpingitis following artificial abortions, the use of intra uterine contraceptives or chronic ascending gonorrhea, is the most frequent cause of ectopic pregnancy. A congenital factor causing ectopic pregnancy is hypoplasia of the genital organs, and especially of the fallopian tubes, which in cases of genital infantilism are thin, long and winding. In these cases the ovum gets stuck easily, probably not only because of the small size and winding configuration of the tube but also as a result of insufficient peristalsis.

However, these acquired or congenital changes affect both tubes equally and they do not explain why the right tube should be involved more frequently than the left. The appendix has been blamed for this involvement of the right tube more often than the left. In the history in cases of ectopic pregnancies one very often finds that the appendix has been previously removed or that attacks of appendicitis have taken place. This also occurs, of course, in a large number of other cases and it is hard to tell whether a previous acute or chronic appendicitis and adhesions or changes following surgical procedures have anything to do with the subsequent development of tubal pregnancies on the right side. Very often the close proximity of the appendix to the right fallopian tube leads to secondary involvement of one organ after the other becomes diseased and this is especially true following local peritonitis with serous or purulent secretion. The fallopian tube, as an open organ is more likely to undergo changes in its mucous membrane than any other organ in the abdominal cavity. Frequent inflammation of the appendix may therefore play a rôle in the etiology of right tubal pregnancies in a certain percentage of cases. Since we had in our series patients who had had previous miscarriages as well as trouble with the appendix, and since in cases of chronic salpingitis pa-

tients do not always confess having had a previous gonorrheal infection it would perhaps lead to misinterpretations if we should try to draw conclusions as to the etiology of the ectopic pregnancy from our figures.

Another possibility of explaining the more frequent occurrence of tubal pregnancies on the right side is based on an observation which we did not find mentioned in the literature. A larger percentage of people are accustomed to sleeping on the right side than on the left, probably because lying on the left side sometimes causes uneasiness because of pressure on the heart. Many therefore turn from lying on their backs to their right side.

Now, usually, the fimbria of the tube are said to surround the ovary so that the ovum after leaving the ovary, does not go into the abdominal cavity at all but immediately into the tube. The ovary, however, is not always surrounded by the ampulla of the tube, and at operation one more frequently sees the tubal ampulla at varying distances from the ovary of the same side, so that it may be difficult to understand how the ovum could find its way into the tube. This is, of course, due to peristalsis of the tube exercising a suction which moves particles from the abdominal cavity into the uterine cavity. This has been shown experimentally by injecting colored material into the peritoneum. In cases in which the ovary on one side and the tube on the other side have been previously removed and in which subsequent pregnancies occur, the ovum must have migrated from one side to the other before entering the tube. In a goodly number of cases the ovum after the bursting of the follicle moves freely and passively in the abdominal cavity. Therefore since it would follow the law of gravity, it would appear that it might more often drop to the side on which most people are accustomed to sleep which is the right side. The law of gravity not only applies to freely movable bodies within the abdominal cavity but also to partly fixed organs. The uterus, for example and especially during pregnancy when it is higher up in the abdominal cavity and heavier, is more often found tipped to the right side than to the left and questioning will often elicit this fact. To explain the more

frequent occurrence of right tubal pregnancies, therefore, there may be pathological reasons, such as appendicitis, and mechanical reasons, such as the custom of most people of sleeping on the right side. As has been said, in this series of cases the ectopic pregnancy was in the right tube in 77 cases, and in the left in 63.

Concerning the question of fertility and sterility following ectopic pregnancies in our series of 142 cases, we have divided the cases into those in which the patients were sterile or were sterilized after the operation and those in which the patients still had the possibility of subsequently becoming pregnant.

STERILITY FOLLOWING ECTOPIC PREGNANCIES

Of the 142 patients, 42 were sterile or could not for various reasons be expected to become pregnant. In group I, hysterectomy, there were 4 cases, in group II, both tubes removed at clinic, there were 19 cases, in group III, one tube removed previously, the other at clinic, there were 10 cases, in group IV, death, no operation done, 1 case, group V, menopause by x-ray, 1 case, miscellaneous, 7 cases, making a total of 42 cases.

Group I In group I, hysterectomy was performed in 4 cases (total in 1 case, subtotal in 3). The 3 subtotal hysterectomies were performed because of multiple fibromyomas found in the uterus at the time of operation. In cases in which only a single fibroma was encountered, myomectomy was performed in order to save the uterus and to preserve fertility. Total hysterectomy was performed in a case of severe, old pelvic inflammation. The ectopic pregnancy was located in the right tube. In the left adnexa there was a tubo-ovarian abscess.

Group II In 19 cases it seemed advisable to remove both tubes, mostly because of chronic salpingitis. It has been suggested also by others that the opposite tube should be removed if macroscopically it proves to be diseased, since such patients are likely to have another ectopic pregnancy later. In cases in which there have been previous normal deliveries with living children and the patient is close to the menopause, one should not hesitate to remove the other tube in case of di-

sease. On the other hand one should not make a practice of removing both tubes in cases of ectopic pregnancy. Many normal tubes show certain changes which are associated only with tubal pregnancy on the other side and are of no subsequent importance. Torre, in his study of 482 cases of ectopic pregnancy, found that in 59 per cent of the cases the ectopic pregnancy seemed to affect the opposite adnexa. Such changes are due mostly to the blood clot in the pelvis and to reactive swelling. It must be left to the judgment of the surgeon, therefore, whether he expects that these changes are likely to become chronic or not.

Older lesions, which result from previous infections, can usually be easily distinguished from these changes which accompany tubal pregnancy on the other side. These older lesions are more likely to favor recurrence of the ectopic pregnancy, and removal of both tubes should be considered only in such cases.

One fact should be kept in mind that the mortality in recurrent ectopic pregnancies is higher than in primary ectopic pregnancies. In Torre's series the mortality for primary ectopic pregnancies was 2.49, whereas for recurrent extra-uterine pregnancies it was 4.54.

We would like at this point to give a brief report of one of our cases in which removal of both tubes was done not only because of an old inflammation, but because of 8 previous operations, 3 of which had been laparotomies. It did not seem advisable, therefore, to expose this young woman to more pelvic surgery. This patient was 28 years old when she came to the clinic in May, 1931, with a left tubal pregnancy. She had previously undergone appendectomy for acute appendicitis in 1920, exploration for abdominal pains (with negative results) in 1921, in March, 1923, an ischio-rectal abscess had been opened, tonsillectomy was performed in 1923 and, in May of that year, the ischio-rectal abscess was reopened, the abscess was again opened in 1924; cesarean section was also performed in 1924 because of delayed labor, and in 1931, dilatation and curettage were performed for metrorrhagia. On her admission in May, 1931, right salpingo-oophoritis was present in addition to the left ectopic pregnancy. Left sal-

pingectomy, right salpingo-oophorectomy and suspension of the uterus were performed. Sterilization is definitely indicated in such instances.

Group III In 10 of our cases one tube had been removed previously, and in 3 of these cases there had been an ectopic pregnancy. In the other cases chronic inflammatory conditions or cysts had been the reason for removing the tube.

The following is a brief report of these 3 cases of recurrent ectopic pregnancy.

The first patient, a woman 29 years old, had had two miscarriages (in 1924 and 1925), a left tubal pregnancy (in 1930) and left salpingectomy had been performed (1925) for recurrent tubal pregnancy on the right side. Right salpingectomy was then performed at the clinic. There was no doubt in this case that the miscarriages and the consequent changes in the uterus and adnexa were the reasons for the development of the recurrent ectopic pregnancies. It is not necessary, however, that a macroscopically visible salpingitis be present for the development of an ectopic pregnancy after a miscarriage. The endometritis sometimes involves only the interstitial part and the mucous membrane of the inner third of the fallopian tube, which inhibits the passage of the fertilized ovum into the uterine cavity.

The patient in the second case was 33 years old. In 1931 she had had an ischioectal abscess. In 1932 a right tubal pregnancy, and the right tube and appendix had been removed. In 1933 she had a normal full term pregnancy with delivery by forceps. In 1935 she had a left unruptured ectopic pregnancy and left salpingo-oophorectomy was performed at the clinic. Besides the ectopic pregnancy chronic salpingitis was found. Since the forceps delivery had occurred between the two ectopic pregnancies the changes in both tubes which led to the ectopic pregnancies must have been present before and could not have been the result of the instrumental delivery. There was nothing significant about the patient's history other than the appendectomy and the ischioectal abscess. Inflammation of the right tube secondary to appendicitis may occasionally attack the left tube also. Whether this was true in this case is questionable.

The third patient was 36 years old. In 1920 she had had a right tubal pregnancy and the right tube had been removed. In 1921 and 1929 she had had two normal full term deliveries. In 1931 she had a left ruptured ectopic pregnancy and left salpingo-oophorectomy was performed at the clinic. In 1935 she had acute purulent appendicitis and appendectomy was performed. In this case the acute appendicitis followed two ectopic pregnancies. The patient had been married twice. We are not able, however, to give any reasons for the development of the tubal pregnancies. There may have been something

in her history which would have accounted for it and which she did not tell us.

In groups II and III we included not only cases in which the tubes were entirely gone, but also those in which a stump of the tube was left. If the outer third, the ampulla of the fallopian tube, has been resected, the inner two thirds or whatever is left do not function as a patent canal. The opening of the tube after resection of the ampulla becomes closed by scar tissue. Even if it would stay open, the muscular apparatus of the canal would not be sufficient to suck the ovum into the lumen. Therefore neither an intra uterine nor extra uterine pregnancy is to be expected, and the patient has to be regarded as sterile. To preserve fertility it is necessary to save the ampulla of at least one tube. Thus, of course, is possible only in cases in which the tubal pregnancy is found in the middle third, the inner third, or in the interstitial part. Excision of the involved part and reunion of both ends can be done in cases of ectopic pregnancy in the middle third and excision and reimplantation of the tube into the uterine cavity can be done in cases in which the ectopic pregnancy is located in the inner third or interstitial part. No such operation, however, was performed in our series. The possibility of later pregnancies after plastic operations of this type are very limited, and such operations are advisable only in cases in which the patient is very anxious to preserve the slightest chance of subsequent pregnancy. The psychologic effect has also to be taken into consideration, even if the practical effect should be poor. In emergency cases, when the patient has lost a considerable amount of blood, plastic surgery is not advisable and the simplest and quickest procedure is the best. On the other hand it should be kept in mind that as far as subsequent pregnancies are concerned plastic surgery on a fallopian tube after an ectopic pregnancy can bring about a more hopeful result than when carried out on a chronically inflamed tube. The results of plastic procedures following chronic salpingitis especially in cases of hydrosalpinx with reopening of the ampulla are very poor.

After plastic surgery on the fallopian tube following two ectopic pregnancies there is a

chance for a third tubal pregnancy. A case of this was reported by Ortenberg in 1931. His patient had the first ectopic pregnancy in the right tube, which was removed. The second ectopic pregnancy occurred in the left tube, which was ruptured. The ruptured part was excised and both ends were reunited. The third ectopic also occurred in the tube, and left salpingectomy was performed. The last ectopic pregnancy was evidently caused by the scar of the plastic operation. The ovum was sucked into the ampulla but could not pass through the circular scar. As has been said, this might have happened not necessarily because the canal was too narrow or entirely obstructed at the site of the former operation, but because of interference with muscular peristalsis. Probably in this case there was a combination of functional and mechanical causes.

Group IV. As mentioned before, one patient died before she could be operated on. She had entered the hospital in shock, her blood pressure being 58 systolic and 38 diastolic, her pulse rate 108, and her temperature 94.7 degrees F. She fainted several times, vomited, and had diarrhea, and air hunger. She received a transfusion of 500 cubic centimeters of blood which relieved her air hunger for a while, but her pulse rate went up to 150 and her temperature went down to 92.5 degrees F and she died.

Group V. One patient received roentgen treatments after operation in order to effect sterilization, endometriosis having been found at operation. This patient was 31 years old at the time of her ectopic pregnancy in 1933. She had had 2 intra-uterine pregnancies before, 1 full-time with forceps delivery and 1 miscarriage. Besides this, she had undergone an appendicectomy and had had chronic perimetritis and endocervicitis, which had obviously developed after the miscarriage. In October, 1933, right salpingectomy was performed for ectopic pregnancy in the right tube. There was a cyst of corpus luteum the size of a baseball in the right ovary which had to be resected too. In addition, spots of endometriosis were found over the bladder and around the uterosacral ligaments. The left adnexa were macroscopically normal.

In view of the fact that the patient wished to have more children these areas of endometriosis were left alone. After the patient recovered from the operation, pains in the pelvis and more or less continuous uterine bleeding developed on account of the endometriosis. She was given a menopausal dose of roentgen-rays in February, 1934.

Group VI. The last group of patients who had to be regarded as sterile after the operation contained those who were not sterile in the anatomical sense, but in whom further pregnancies could not be expected for other reasons. One patient, for example, with only one tube left had a negative Rubin's insufflation test. Two patients came into menopause shortly after the ectopic pregnancy. Three patients were widows or divorced.

FERTILITY FOLLOWING ECTOPIC PREGNANCIES

In the 100 remaining cases in this series subsequent pregnancy was at least theoretically possible. Seven of these patients were under observation at the clinic, in the 93 remaining cases we had to send letters of inquiry. Seventy-seven (82 per cent) of the patients answered, 4 letters were returned unclaimed. Twelve letters were not answered, even after writing a second time. Therefore, the number of cases in this group in which we are able to report the subsequent history following an ectopic pregnancy was 84. Two of these patients died during the period of observation, 1, 5 years and the other 7 years after operations for an unrelated condition. Their cases are of course included in this group because there was a chance of their having become pregnant in the interval.

Since the time which had elapsed since the ectopic pregnancy varied between 1 and 10 years, the chance for a subsequent pregnancy, and especially for several pregnancies, was different. Thirty-one of 84 patients (36.9 per cent) became pregnant later, 28 (33.3 per cent) having intra-uterine pregnancies, and 3 (3.6 per cent) having a recurrent extra-uterine pregnancy.

Forty-seven intra-uterine pregnancies occurred in these 28 patients. Thirty-two of these resulted in full time deliveries with 29 living children; there were 3 stillbirths. The

mother of 2 of the stillborn babies had syphilis. In the group of intra uterine pregnancies there were 4 premature deliveries, 10 mis-carriages, and 1 hydatisiform mole.

This number of 47 intra uterine pregnancies in 84 patients operated on for ectopic pregnancy shows that it was worth while to save at least one tube and ovary if the gross anatomical lesions in the remaining adnexa were not too severe. In this group there were, of course, patients whose other tube was more or less affected. Without an insufflation test it is almost impossible to say whether the remaining tube is patent or not. Therefore, we are sure that we have in this group patients who are practically sterile because of obstruction or changes in the remaining tube. On the other hand, there may be a considerable number of patients in this group with a patent tube who did not desire to become pregnant again and who used contraceptive methods to prevent it. If we had a way of finding out what number of patients were actually willing to become pregnant again and if we could exclude those who would not take the chance of subsequent pregnancy, the percentage of subsequent pregnancies after one ectopic pregnancy might be higher.

Concerning the surgical procedure, usually only the pregnant tube was removed and both ovaries were left. If one ovary has to be removed together with the tube, the chances for subsequent pregnancy do not seem to be much less, at least not 50 per cent less. It is of course much better to save both ovaries, for one never knows what is going to happen. Cysts and other pathological changes some times may make it necessary to remove one ovary later, which would bring the patient into menopause and cause sterilization. We therefore remove the ovary of the diseased adnexa only if it is seriously affected by the ectopic pregnancy, for instance, by a peritubal hematocoele in cases of elderly patients or if it contains cysts or abscesses. Subsequent pregnancies occurred in this group among patients with both ovaries left as well as among those with only one left. Of the 32 full time pregnancies, 21 occurred in 14 patients with both ovaries left (after salpingectomy), 11 occurred in 7 patients with 1 ovary left (after salpingo-

ophorectomy). In this latter group of 11 full time pregnancies, 6 came from the right ovary, 5 from the left.

There is a widespread opinion among laymen, and even among some physicians, that the right ovary delivers only one sort of ova (only male or only female) and the left ovary the opposite, or that one side delivers two-thirds of the ova of one sex and only a third of that of the other. That this is not true was evidenced by the fact that there were 3 boys and 1 girl in cases in which the right ovary was preserved and 3 boys and 2 girls in cases in which the left ovary was preserved. One of our patients who had her left ovary removed had a boy and a girl later, both ova having come from the right ovary.

The difference in the results in our series from those obtained in the earlier series reported by Mason and Simon is as follows. First there was a higher percentage of patients with subsequent pregnancies among those traced for the period 1903 to 1926. In their series this figure was 44 per cent, for our series covering the period from 1926 to 1935 it was 37 per cent. Their patients were under observation over periods as long as 24 years, whereas ours were under observation for a period of 10 years or less. As a result the average time for observation and subsequent pregnancies was shorter in our group. On the other hand economic conditions during the period from 1926 to 1935 may have caused voluntary restriction of the number of pregnancies. In addition, the percentage of patients who were traced in the first period was smaller (198 of 437 or 45 per cent) than for the second period (84 of 142, or 59 per cent). This may have resulted from the fact that the average time after patients had left the clinic was longer and it was therefore more difficult to get in touch with them.

Another difference between the results of the two series was the higher percentage of recurrences of ectopic pregnancy after operation at the clinic. There were 12 such cases or 6 per cent, between 1903 and 1926, only 3, or 3.6 per cent, between 1926 and 1935. In other words patients who had the possibility of becoming pregnant after an ectopic pregnancy had another ectopic pregnancy in 1 of

16 instances between 1903 and 1926, in 1 of 28 between 1926 and 1935. The percentage of recurrences dropped from 6 per cent to 3.6. This may have had something to do with changes in the type of operation chosen in a given case, or changes in surgical technique, and so forth.

We should like to give a short report of these cases of recurrent ectopic pregnancies which occurred in the period from 1926 to 1935.

The first patient was 29 years old and had never been pregnant before. In March, 1935, she was admitted with a left ruptured ectopic pregnancy and left salpingectomy was performed. The uterus and right adnexa appeared normal. In July, 1936, she had a recurrent ectopic pregnancy in the right tube and the distal half of the right tube was removed. No adhesions were found at this second operation. This case belongs to the group in which neither from the history nor at exploration could a cause for the ectopic pregnancy be found. The second patient, a woman 26 years old, had had subacute appendicitis but had not been operated on. In 1929 she had had a left tubal pregnancy, and partial left salpingectomy was performed. Appendicectomy was also performed at this time. In 1931 she had a recurrent ectopic pregnancy in the right tube and was operated on elsewhere. The cause for these ectopic pregnancies may be attributed to the appendicitis. Especially when appendicitis is present for a long period of time and operation is not performed, peritoneal changes and involvement of the tubes are likely to occur. The third patient was 29 years old. She had had one full time pregnancy in 1925. Dilatation and curettage with suspension of the uterus (Baldy-Webster type), had been performed in 1928. She then had a left ruptured tubal pregnancy in 1935 and left salpingo-oophorectomy was performed. She had a recurrent ectopic pregnancy in September, 1936, and right salpingectomy was performed. There was no history of appendicitis, gonorrhea, or of miscarriage. The ectopic pregnancies occurred after a full time delivery and after a suspension operation. After any type of operation for suspension of the uterus it is theoretically possible that the fallopian

TABLE II—INCIDENCE OF RECURRENCES IN ECTOPIC PREGNANCY

Author	Total number of ectopic pregnancies reported	Recurrences	Percentage
Bamberger	150	6	4.0
Falk and Rosenbloom	313	8	2.56
Hirst (quoted by Mueller)	167	7	4.2
Smith (quoted by Lewis)*	1608	58	3.6
Urdan	474	27	5.7
Total	2712	106	3.9

*Collected cases of American Gynecological Society.

tubes are bent in a way that the fertilized ovum may get stuck and this is especially true when the round ligaments are drawn through the broad ligaments below the tubes and become fixed on the posterior wall of the uterus. Certain pressure may be exerted on the tubes and the passage of the ovum may be more difficult. We do not contend that this was what actually happened in this last case, but we do believe that bringing organs into unnatural positions may result in unnatural functions and results.

In the literature, the percentage of recurrent ectopic pregnancies is not given by reviewing the cases of those patients who had the possibility of subsequent pregnancies, but by giving the total number of ectopic pregnancies observed in a certain hospital. Figures obtained in this way include those patients who could not become pregnant after their first ectopic pregnancy. Rabinovitz, in 1911, listed the cases of recurrent ectopic pregnancy reported by 12 authors and added 2 cases of his own. Altogether this made a total of 147 cases of recurrent ectopic pregnancy, or 3.9 per cent recurrent ectopic pregnancies out of the series of ectopic pregnancies. The same figure was obtained when we reviewed the literature for the following 26 years (Table II). We give only the reports of authors who list more than 100 cases of ectopic pregnancy.

The total number of ectopic pregnancies at The Mayo Clinic between 1903 and 1926 was 445, the number of recurrent ectopic pregnancies 18, or 4.1 per cent. The total number of ectopic pregnancies between 1926 and 1935

was 148 (in 142 patients) and the number of recurrent ectopic pregnancies was 6, or 4.0 per cent. The percentage of recurrences was essentially the same.

The percentage of 3.6 for recurrent pregnancies, 3 of 84 patients for those who could subsequently become pregnant is low, since all those patients were excluded who could not become pregnant after treatment of the first ectopic pregnancy at the clinic. Since the total number of our cases is not very large, we believe that one should expect a somewhat higher percentage of recurrent ectopic pregnancies if the possibility of further pregnancy is present. It must be kept in mind, however, that recurrent ectopic pregnancy also occurs in cases in which patients have had one or more intra uterine and full time pregnancies after the first extra uterine pregnancy.

SUMMARY AND CONCLUSIONS

In the 10-year period from January 1, 1926, to December 31, 1935, 142 patients with ectopic pregnancies were seen at the clinic. There were 140 tubal pregnancies, 1 ovarian pregnancy, and 1 abdominal pregnancy.

One hundred forty one of the patients were operated on without a death, the remaining patient having come to the clinic in shock and having died before any surgical procedure could be attempted. The surgical mortality was therefore 0.0 per cent, the total mortality 0.7 per cent.

In 77 cases (55 per cent) the tubal pregnancies occurred on the right side, in 63 (45 per cent) on the left. The higher percentage of right tubal pregnancies can be explained on pathological (former inflammations and operations on the appendix) and on mechanical grounds.

Forty two of the 142 patients (29.6 per cent) could not have been expected to have subsequent pregnancies for various reasons. These patients were practically sterile or became sterilized after the ectopic pregnancy. Three of these patients had recurrent ectopic pregnancies when they first came to the clinic.

One hundred of the 142 patients (70.4 per cent) had the possibility of further pregnancy at least theoretically. Eighty four of them were traced, and 31 (36.9 per cent) became

pregnant later, 28 (33.3 per cent) having intra uterine pregnancies, and 3 (3.6 per cent) having recurrent extra uterine pregnancies. These 28 patients had 47 intra uterine pregnancies, 32 of which resulted in full time deliveries with 29 living children, the others resulted in miscarriages and premature deliveries. Twenty one full time pregnancies occurred in 14 patients after salpingectomy, both ovaries being preserved, 11 full time pregnancies occurred in 7 patients after salpingo oophorectomy, one ovary being preserved.

From a review of the literature it was found that recurrent ectopic pregnancies occur in about 5.9 per cent of cases of ectopic pregnancy. Considering only those patients who have the possibility of subsequent pregnancy after their first ectopic pregnancy one would expect this percentage to be higher. In our series of 84 patients who had had their first ectopic pregnancy treated at the clinic and who had the possibility of further pregnancy, the percentage was somewhat lower (3.6 per cent). The number of recurrent ectopic pregnancies occurring in a total of 142 patients (including those who had their first ectopic pregnancy treated elsewhere) was 4.0.

Since the probability of intra uterine pregnancy after one ectopic pregnancy is about ten times larger than the probability of another ectopic pregnancy, conservative surgery is advisable in order to preserve fertility. Only if the other tube is severely diseased should it be removed. In this connection it should be kept in mind that the non pregnant tube undergoes certain acute changes in more than 50 per cent of tubal pregnancies such as swelling, redness and peritoneal friction produced by hematomas. These changes however, more or less disappear and do not interfere with subsequent fertility.

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RENAL TUBERCULOSIS IN PATIENTS WITH ACTIVE PULMONARY TUBERCULOSIS

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INTEREST in the urological findings in patients residing in a health resort devoted largely to the treatment of pulmonary tuberculosis has afforded a unique opportunity for studying certain aspects of the problem of urogenital tuberculosis hardly available to the urologist connected with metropolitan institutions in which renal tuberculosis is seen only occasionally, and for collecting certain data which may be of value in completing our concept of the processes associated with tuberculous invasion of the urinary tract.

A review of the more recent literature on the subject reveals the following conclusions which are more or less widely accepted at the present time and which may be taken as the basis of facts on which a discussion may be built: (1) tuberculosis of the kidney is secondary to a lesion elsewhere in the body from which tubercle bacilli have been disseminated usually through the blood stream; (2) renal tuberculosis is bilateral in the majority of cases (Medlar); (3) renal tuberculosis may occur as one or both of two types: (a) the so-called 'pathological' (usually military and non-progressive) form in which tubercles are found in the cortex or medulla and do not communicate with the renal pelvis and (b) the so-called 'clinical' (ulcerative) form in which there is ulceration and destruction of a pyramid or calyx; (4) the disease may be present in the 'pathological' form in one kidney and in the 'ulcerative' form in the other; (5) the 'pathological' form may undergo resolution and ultimate healing while (6) demonstration of an example of a healed 'clinical' or ulcerative lesion is still lacking, and (7) the presence of tubercle bacilli in a specimen of ureteral urine is *de facto* evidence of the existence of tuberculosis in the kidney from which it came.

As corollaries of the foregoing, it is the consensus of urologic opinion that when the pres-

ence of an ulcerative lesion in one kidney has been established, especially when the urine from that kidney contains leucocytes, red blood cells, and albumin in addition to tubercle bacilli and the opposite kidney has been found to be "normal," the surgical removal of the kidney containing the destructive lesion is indicated. On the other hand when both kidneys show ulcerative lesions, surgical treatment, except under special circumstances is contra-indicated and the patient is best treated by medical means. It is generally felt that the prognosis in cases subjected to nephrectomy for unilateral disease is fairly good while in cases with bilateral disease and those with unilateral lesions treated medically, the outlook is uniformly poor although the expectation of life may be for many years.

Under certain circumstances it would appear that surgical treatment may be of value in cases of bilateral renal tuberculosis. One such exception may occur when there is persistent gross hematuria from one kidney, as occurred in one of our cases. Again if one of two infected kidneys has had its function entirely destroyed and is present as a virtual tuberculous abscess in the loin and especially if the ureter on that side is blocked, the patient will be better off if the functionless kidney is removed. Heyes and Ferguson and others hold that if the pyelogram be normal on one side in cases from which tubercle bacilli have been recovered from both kidneys, operation may be done on the kidney showing pyelographic deformity. There is a lack of agreement among urologists as to the advisability of operation in the presence of active and particularly far advanced pulmonary tuberculosis; we have had no hesitancy in advising and carrying out an indicated nephrectomy in several such cases and thus far have had no cause to regret our decision. Tuberculosis is among the most unpredictable of diseases and apparently 'hopeless' cases

often live a surprisingly long time. For this reason we believe that a patient should be given every possible chance by removing a kidney which can be only a liability in his efforts to build up his bodily defences.

The results of this study would tend to indicate that in certain details our concepts of renal tuberculosis may well be modified, especially in cases associated with active pulmonary tuberculosis, when adequate general hygienic treatment for tuberculosis is available. The distinction between "surgical" and "medical" tuberculosis has been drawn so fine that it is not out of place to reiterate the fact that tuberculosis is *always* a general disease and that the removal of a single focus does not rid the body of the disease. Such a result can come only through efforts to build up the patient's resistance to a point at which he can stop the spread of the disease and encapsulate the existing foci in scar tissue.

It may also be emphasized that tuberculosis of an organ either progresses or heals. Active tuberculosis does not stand still and in the case of the kidneys at least it is a question whether one ever encounters quiescent or latent disease such as has been described in the lungs. For this reason we question the occurrence of the so called "remissions" in renal tuberculosis, i.e., periods of varying length of time during which pus and tubercle bacilli are absent in the urine obtained from a kidney previously shown to be tuberculous. There is ample reason for believing that minute ulcerations may "shower" tubercle bacilli intermittently and that the urine obtained from a given kidney may be "negative" today and "positive" tomorrow, just as the sputum from a case of early pulmonary tuberculosis may alternate from time to time. We recognize, then, (1) active tuberculosis of the kidneys in which tubercle bacilli are being thrown off in the urine if ulceration of the pelvis is present, or will be sooner or later if the lesion is progressive and is not yet in open communication with the pelvis, and (2) healed or healing renal tuberculosis which may or may not be accompanied by calcification. One is justified, therefore, in assuming that if tubercle bacilli have once been demonstrated in a ureteral specimen of urine and *repeated* later

examinations fail to reveal the bacilli, that the renal lesion has healed. The cases observed by us that went on to healing are undoubtedly examples of very minute ulcerations of the tip of a papilla, ulcerations such as have been described by Lieberthal and Huth that are too small to cause a visible deformity of the pyelogram and whose scars could be demonstrated only by laborious work of the type done by Medlar. As far as the author knows, this has not been done.

The records of the Saranac Laboratory for the Study of Tuberculosis (in which most of the urines from the private sanatoria in Saranac Lake are examined) and those of the Trudeau Sanatorium Laboratory have been examined to determine how often acid fast bacilluria and especially tubercle bacilluria are found in patients with pulmonary tuberculosis whose urines showed other abnormal elements. Not only are the results interesting but the differences are significant inasmuch as examinations for organisms at the Saranac Laboratory are made on the finding of an abnormal number of pus cells in a voided morning specimen of urine while those at the Trudeau Sanatorium are made on 24 hour specimens from patients who had previously shown albumin in a routine urinalysis. The results are shown graphically in Diagrams 1 and 2.

Other data are available also from these studies. A tabulation of the analysis for the Saranac Laboratory series is given in Table I. It will be seen that in this laboratory, where all urine examinations have been made by the same technician for a period of approximately 20 years, there is roughly one chance in eight of missing acid fast bacilli in smears of the sediment of male urines as compared with one in twenty in specimens from females. It is also apparent that 66 per cent of the male urines in which acid fast bacilli were found on smear were positive for tubercle bacilli by guinea pig inoculation as compared with only 26.6 per cent of the females. This difference is probably due, not only to the well established fact that renal tuberculosis is more frequent in males than in females, but also to the presence of lower genital tract tuberculosis in many of the males. And finally, it would

SARANAC LABORATORY SERIES BASED ON PRESENCE OF LEUCOCYTES IN VOIDED SPECIMENS SUBMITTED FOR ROUTINE ANALYSIS

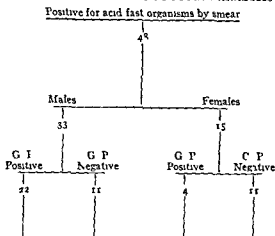


Diagram 1 Acid fast bacilli in urines from patients with active pulmonary tuberculosis

appear that the incidence of non tuberculous forms of acid fast bacilli is about twice as great in females as in males

On the other hand at the Trudeau Sanatorium acid fast bacilli were found much more frequently in smears made from the sediment of 24 hour specimens. A search of the records for the 10 year period covered by the study revealed only one instance in which smears from a urine subsequently proved to contain tubercle bacilli by guinea pig inoculation were reported negative. Compared with the incidence of tubercle bacilli in the Saranac Laboratory series, the Trudeau Sanatorium figures show 55 per cent for the males and 35 per cent for the females a somewhat higher proportion of females to males than obtains in the former. This may be explained in part, by the fact that the Trudeau Sanatorium admitting only relatively early cases of pulmonary tuberculosis, does not encounter as high an incidence of lower genital tract lesions and other extrapulmonary forms of the disease in the males as are seen in the more advanced cases in the village.

In summary, of 88 cases of pulmonary tuberculosis in which acid fast bacilli were found in smears of voided urine sediment, guinea pig inoculation proved the organisms to be

TRUDEAU SANATORIUM SERIES BASED ON PRESENCE OF ALBUMIN IN VOIDED SPECIMENS SUBMITTED FOR ROUTINE ANALYSIS SMEARS MADE ON SEDIMENT OBTAINED FROM SUBSEQUENT 24 HOUR SPECIMEN

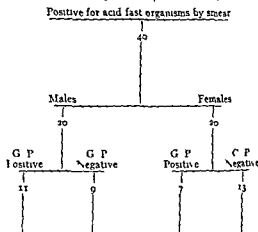


Diagram 2 Acid fast bacilli in urines from patients with active pulmonary tuberculosis.

tubercle bacilli in 62.3 per cent of the males and 31.4 per cent of the females

Other features of the urines in the Trudeau Sanatorium series are detailed in Table II. It will be seen that findings of "many pus cells," albumin and casts were reported approximately twice as frequently on urines containing tubercle bacilli as in those containing non pathogenic forms of acid fast bacilli and that red blood cells also occurred more frequently in the pathogenic bacillurias.¹

A word may be said at this point on the respective merits of guinea pig inoculation and cultural methods in the identification of tubercle bacilli in specimens of urine. In both the Saranac Laboratory and the Trudeau Laboratory, guinea pig inoculations are used routinely in the clinical diagnostic work although cultures have been made simultaneously for the past several years at Trudeau. During the time that both methods have been in use at the Sanatorium, the bacteriologist reports that in only one instance was a positive culture obtained when the guinea pig proved to be negative. Although requiring more technical

¹ Although albuminuria in a per lous specimen was taken as the indication for examination of 24 hour specimens for acid fast bacilli not all specimens thus collected showed albumin

TABLE I — URINES EXAMINED BY GUINEA PIG INOCULATION AT SARANAC LABORATORY 1928-1936 (INCLUSIVE)

	Males		Females	
	No	Per cent	No	Per cent
Acid fast bacilli negative on smears Guinea pigs negative	39	47.5	25	59.5
Acid fast bacilli negative on smears Guinea pigs positive	10	12.2	2	4.7
Acid fast bacilli positive on smears Guinea pigs negative	11	13.5	11	26.2
Acid fast bacilli positive on smears Guinea pigs positive	22	26.8	4	9.5
	82	100.0	42	100.0

skill, cultures are undoubtedly of value especially when one wishes a report in less than the 6 weeks usually required with animal inoculations. The "micro-colony" method devised by Fischer and Uργοiti is now being tested out in the Trudeau Sanatorium Laboratory in the hope that by its use one may be able to identify the tubercle bacilli within the first 2 weeks. Until more data have accumulated, both methods will be used simultaneously.

Carrying the study a step farther, the autopsy protocols of 239 individuals who died with active pulmonary tuberculosis in Saranac Lake between 1914 and 1937 were examined to determine the incidence of renal lesions. Although the examinations were all made in a routine manner and microscopic examinations of the kidneys were omitted in some instances, no questionable lesions are included and the figures may be lower than the actual facts warrant. The results are shown in Table III in which the results of a somewhat similar study at the Sea View Hospital reported by Greenberger are tabulated in parallel columns for comparison.

Within the past few years an increasing number of cases of silico-tuberculosis have been seen in Saranac Lake. As the silicotic fibrosis about the lesions of pulmonary tuberculosis prevent hematogenous and lymphogenous spread of tubercle bacilli, one might expect the incidence of renal involvement to be lowered in the male group. Actually, however, the figure is practically identical with that obtained in a similar study of a smaller

TABLE II — URINALYSES OF ACID FAST POSITIVE URINES AT TRUDEAU SANATORIUM

Total pathogenic = 18			Total non-pathogenic = 22	
No	Per cent		No	Per cent
17	94.5	Many pus cells	10	45.5
11	61.0	Albumin positive	6	27.0
8	44.5	Casts positive	5	23.0
5	28.0	Red blood cells positive	4	18.0

group of cases of uncomplicated pulmonary tuberculosis made several years ago.

Calcification was not seen in any of the cases coming to autopsy. It has been encountered but once in the patients operated upon and then only as a small plaque in the pelvis in a patient who had but recently come to Saranac Lake. This is interesting inasmuch as the incidence of calcification seems to vary markedly in various reported series. Renal calculi have not been encountered in any of the postmortem or operated upon patients.

Of these 239 patients, 67 (28.4 per cent) showed tuberculous lesions in the kidneys as compared with Greenberger's figure of 50.4 per cent. The explanation of the difference may lie in the fact that all of the Saranac Lake group were adult members of the white race infected with a chronic type of the disease, although several died with a terminal miliary dissemination, whereas Greenberger's series includes children, negroes, and the more acute types of tuberculosis.

There were 158 males in the group of which 49 (31 per cent) showed renal lesions. Of the 81 females, 18 (22 per cent) showed involvement of the kidneys.

The positive cases were divided into two groups. (A) those with miliary lesions 1 to 2 millimeters in diameter, usually of a non-progressive nature, which in many cases may have been the result of a seeding of the kidneys that took place within the last few weeks of the patient's life, and (B) those with larger and in many instances ulcerative lesions in the presence of which one might expect to find organisms in the urine during the life of the individual. The first group may be called the "pathological" as compared with the "clinical" lesions of the second group. Cases

TABLE III —INCIDENCE OF RENAL LESIONS IN AUTOPSIES ON TUBERCULOUS PATIENTS

	Sarah Lake series	Percent	Green- berger (Sea- view Hosp.)	Percent
Number of autopsies	230		500	
Number showing renal lesions	67	29.4	252	50.4
Total males	158			
Total males with renal lesions	49	31		
Total females	81			
Total females with renal lesions	18	22		

Group with pathological (non progressive) renal lesions only

	No.	Percent of total autopsies	Green-berger series
Number of cases	50*	30.0	45.6
Bilateral	38	76.0	83.0
Unilateral	12	24.0	17.0
Males	34	68.0	66.7
Females	16	32.0	33.3

Group with clinical (organ tuberculous) lesions

	No.	Percent of total autopsies	Green-berger series
Number of cases	17†	7.2	4.8
Bilateral	15	76.6	58.0
Unilateral	2	11.8	17.0
Males	11	64.7	58.0
Females	6	35.3	42.0

*These cases comprise 30.4 per cent of total positive cases compared with 35.6 per cent in Greenberger's series.
†These cases comprise 25.4 per cent of total positive cases compared with 24.4 per cent in Greenberger's series.

in which 'clinical' disease was present on one side and 'pathological' lesions on the other were classified as 'bilateral clinical'.

In group A there were 50 cases representing 20.9 per cent of the total autopsies and 74.6 per cent of the total positive cases. Greenberger's figures for this group are 45.6 per cent and 85.6 per cent respectively. The military tubercles were bilateral in 38 cases (76 per cent) and unilateral in 12 (24 per cent) with the incidence of bilateral lesions in the two sexes practically identical. Of the 50 cases with pathological lesions 34 (68 per cent) were males and 16 (32 per cent) were females.

In group B there were 17 cases representing 7.1 per cent of the total autopsies and 25.4 per cent of the total positive cases. These figures may be compared with Greenberger's incidence of 4.8 per cent and 14.4 per cent, respectively. The disease was bilateral in 15 cases (76.4 per cent) and unilateral in 2 (11.8 per cent). Of these 17 cases of clinical disease, 15 (88 per cent) were males and 2 (12 per cent) were females. This corresponds

fairly closely with Greenberger's figures of 83 per cent and 17 per cent, respectively, for the two sexes.

In the males with renal lesions, 69.3 per cent were military and 30.6 per cent were 'clinical' or 'organ' tuberculosis. Of the females, 89 per cent had military and only 11 per cent 'clinical' tuberculosis. From this it appears that males not only show a greater tendency to develop renal tuberculosis than do females but also that they show a greater tendency to develop clinical or advanced lesions in the approximate proportion of 3 to 1 in this series. This may be compared with Caulk's series of cases in which patients were operated upon at the Barnes Hospital in St. Louis in which the proportion was 6 to 4 and with the collected series of 1,176 patients operated upon cited by him in which the proportion was 5 to 4.

It is interesting to note that the 'pathological' and 'clinical' cases are bilateral in practically equal percentages. In other words, three fourths of this series with renal tuberculosis had bilateral lesions. In Greenberger's study 82 per cent of the military cases were bilateral but only half of the cases with 'clinical' lesions had disease in both kidneys. It is difficult to explain this difference as the work of Medlar has shown bilateral lesions so often that one is led to believe that when a patient has 'clinical tuberculosis in one kidney he may almost always be assumed to have pathological tuberculosis in the other.

It may also be pointed out that when one considers the positive cases in both sexes it will be found that bilateral lesions exist with approximately equal frequency (males 77.5 per cent females 72.2 per cent). Thus it appears that although males are more likely to develop renal lesions—pathological or 'clinical'—than females if the kidneys are involved in the latter the lesions are as likely to be bilateral as they are in the males. This is in accord with the hematogenous theory of renal infection with the tubercle bacillus.

Of the 49 males with renal lesions 12 (24.5 per cent) showed gross lower genital tract lesions as well and 5 (10.2 per cent) showed spinal tuberculosis. Only 1 of the 81 females showed genital tuberculosis thus illustrating,

the inaccuracy of speaking of urogenital tuberculosis in the female. Of the 5 spinal cases, 2 showed bilateral miliary lesions, 2 bilateral ulcerative renal lesions, and 1 had an ulcerative lesion on one side and miliary lesions on the other. The advisability of making a careful study of the vertebral column to rule out Pott's disease in every case of renal tuberculosis is apparent.

The clinical histories of 36 of the 67 cases with renal lesions were available for study and were examined from the standpoint of the urinary findings during life. In only 3 instances was the urine entirely normal and in these 3 cases the last urinalysis had been made some time before death occurred. Autopsy showed all 3 to be cases of miliary lesions.

When one compares the frequency of a report of albuminuria with that of a "few" to "many" pus cells, it is apparent that the latter finding was somewhat more frequent. This would correspond with the observation from the Trudeau Laboratory that "many" leucocytes were found in 67.7 per cent of the urines containing acid fast bacilli and in 94.5 per cent of those showing tubercle bacilli (Table II). In any case, the presence of acid fast bacilli in the urines of tuberculous patients that show either albuminuria or pyuria is sufficiently frequent to warrant a painstaking search for the organisms in a smear of the sediment and either guinea pig inoculations, cultures, or both, in some instances.

Two of the cases coming to autopsy are worthy of special note as illustrative of a fundamental principle in the diagnosis of renal tuberculosis and the difficulty that may attend one in striving to determine the true etiology of a pyuria (Cases J K, a male, and R W, a female). In both these cases guinea pigs inoculated with bladder urine were negative for tuberculosis 2 and 3 months, respectively, before death. The specimens obtained from one (R W) were collected during a cystoscopic examination and pyelograms made at the time were considered normal. This patient subsequently showed acid fast bacilli in the bladder urine and it might be argued that the cystoscopic examination and catheterization of the ureters "lighted up" the process. It would seem unlikely, however, that tuber-

culous abscesses of the kidneys of the size found in these two patients could have developed in 2 or 3 months. The crux of the situation in these 2 cases apparently lies in the fact that at autopsy there was apparently no communication of the abscesses with the renal pelvis. Such a communication must have been present at the time the positive urine was obtained in R W, unless the bacilli came from the opposite kidney, but either closed subsequently or was missed at the necropsy examination.

On the other hand, Case E S, a male, demonstrated that a very small lesion in communication with the pelvis of the kidney will produce a positive urine. In this instance a line of caseation about 1 millimeter in width extended from the middle of a calyx to the tip. Somewhat similar instances have been cited by Lieberthal and Huth in which ulcerated miliary tubercles produced a tuberculous bacilluria and impaired renal function as demonstrated by the sensitive freezing point depression test. These are the types of lesions with, of course, an occasional case with a large parenchymatous abscess of the type described, that may shed tubercle bacilli intermittently and may possibly heal.

CONCLUSIONS

1. Careful and repeated search for acid fast bacilli in smears of the sediment of a 24 hour specimen should be made in every tuberculous patient who shows pus or albumin in the urine.

2. Such smears, properly stained, will show acid fast organisms in a high percentage of positive cases. Doubtful cases and all those in which acid fast bacilli have been demonstrated should be further examined by guinea pig inoculation or culture.

3. Renal tuberculosis is three times as frequent in males as it is in females with pulmonary tuberculosis in this series, and in 76 per cent of these patients the lesions are bilateral.

4. Patients with renal tuberculosis rarely have a "normal" urine although the presence of tubercle bacilluria depends upon the existence of a lesion in communication with the pelvis of the kidney.

The author wishes to express his indebtedness to Mr George Hulpritt of the Saranac Laboratory and to Miss Margery Smith of the Trudeau Laboratory for their assistance in compiling the figures from their respective laboratories and to the physicians of Saranac Lake who placed their cases at his disposal

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THE INFLUENCE OF CERTAIN ANTISPASMODIC DRUGS ON THE INTESTINE OF MAN

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THE facts that many methods are used to induce intestinal motility for relief of postoperative intestinal distention and atonia and that several methods are likewise in use to suppress intestinal motility in conditions such as abdominal cramps associated with intestinal disturbances, indicate that a lack of satisfactory therapy exists in these respects. The literature is voluminous on the use and effect of drugs which stimulate peristalsis by increasing the tone of smooth muscle, principal among which are pituitrin, pitressin, peristaltin, prostigmin, and physostigmine.¹ Just as remarkable is the paucity of the literature on the use of drugs that decrease spasm of smooth muscle.

There are essentially two types of motility in the large bowel: First, there is the rhythmic peristaltic contraction or wave which has to do with moving intestinal contents forward (3). It is described as a wave of contraction preceded by a wave of relaxation. The peristaltic wave is normal and should be aided. Second, there is the contraction that has to do with mixing of intestinal contents, it is not a wave as it occurs only in a localized segment of the intestine and should be combated since it is obstructive in nature. Enormously dilated portions of bowel between regions of markedly contracted bowel are frequently observed at necropsy in cases in which toxemia associated with peritonitis has been present. The administration of morphine, the drug most widely used for relief of postoperative discomfort and of pain, gives rise to a similar picture, that is, regions of contracted bowel alternating with stretches of distended bowel.

METHOD OF STUDY

The combined medical and surgical services which at the clinic deal with diseases of the

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¹This study concerns the action of various drugs which lessen the tone of the musculature of the bowel.

intestine, afforded ample opportunity to observe patients in the manner herein described. Many patients on whom colostomy had been carried out or on whom some surgical procedure had been performed on the large intestine are available at all times. Observations were made whenever the patients desired to contribute to the study and their condition warranted these relatively minor interferences with routine. Each patient was instructed regarding the procedure, which is painless and harmless. It was important that the patient be comfortable during the procedure which lasted, on the average, 2 to 4 hours. Most patients slept during this period. The idle segment of bowel of each patient was thoroughly cleansed with warm physiological saline solution before observations were begun.

APPARATUS

A small, distensible rubber balloon was fastened securely by silk thread to a rubber catheter (No. 16 F.); after the balloon and catheter were lubricated they were inserted through the stoma into the bowel for a distance of 10 to 20 centimeters, far enough so that respirations and movements of muscles of the abdominal wall would not affect the record. By means of a syringe, 8 to 15 cubic centimeters of water was injected into the balloon. The quantity of water used varied depending on the size of the balloon and the amount necessary to bring the water to the proper level in the manometer, that is, on a level with the xiphoid cartilage. Precautions were taken not to distend the bowel by overfilling the balloon with water. The amount to be injected was estimated, in part, before the balloon and catheter were inserted.

So far as we were able to determine, most studies of this nature reported in the literature have been carried out with a closed air system; compression on the air balloon was recorded on a rubber tambour, and by means of a lever,

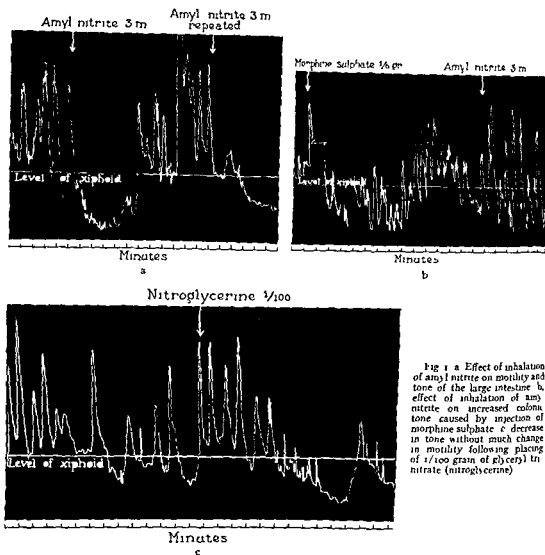


Fig 1 a Effect of inhalation of amyl nitrite on motility and tone of the large intestine b, effect of inhalation of amyl nitrite on increased colonic tone caused by injection of morphine sulphate c decrease in tone without much change in motility following placing of 1/100 grain of glyceryl trinitrate (nitroglycerine)

a record of motility was made on a revolving drum. We feel that a just criticism can be made of this method, the air balloon, by its very nature, distends the bowel and creates motility owing to the presence of distention and because the rubber diaphragm on the tambour was already stretched, increase or decrease in tone could not be recorded accurately by use of the air system.

Our procedure was as follows. The end of the catheter was connected by a hollow glass rod with a piece of rubber tubing 5 feet in

length which was filled with water. This, in turn, was connected with a water manometer similar to the type described by Butsch McGowan and Walters (2). The level of water in the manometer was adjusted to correspond with the same level as that of the xiphoid cartilage and this level was used as a base line, so that increase or decrease of tone could be recorded. By means of a glass float in the manometer on top of the column of water intestinal motility and increase or decrease in tone were recorded on a smoked drum.

Benzedrine 20 mg.

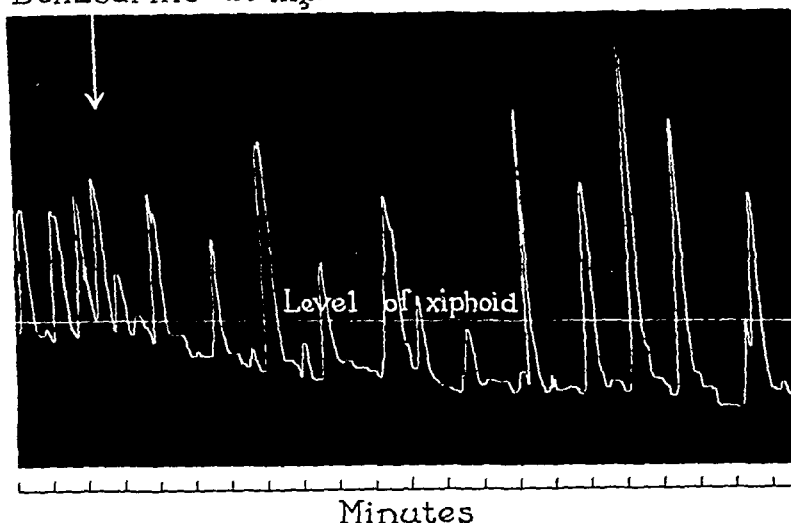


Fig 2 Some decrease in tone without apparent change in motility of the large intestine following intramuscular injection of 0.02 gram of benzedrine sulphate

DRUGS LOWERING BOWEL TONE

Nitrites Inhalation of 3 minims of amyl nitrite produced an immediate decrease in tonicity lasting from 3 to 5 minutes. Peristaltic waves and localized contractions were completely absent. The decrease in tone as represented by the level of water below the base line was marked (Fig 1, a). Immediately after the maximal effect of amyl nitrite occurred the pressure began to increase slowly until it reached its former level.

McGowan, Butsch, and Walters have shown by their studies that if intrabiliary pressure becomes increased, either spontaneously or because of administration of morphine, amyl nitrite will produce a prompt fall in the pressure owing to its antispasmodic effect on the sphincter of Oddi (8). As would be expected an exactly similar state of affairs exists in the large bowel of man (Fig 1, b).

Administration of glyceryl trinitrate in doses of 1/100 grain (0.0006 gm) under the tongue produced a decrease of tone which was less marked but more lasting in its effect than that produced by amyl nitrite. It was frequently observed that after the effect of nitroglycerine was manifest, expulsion of flatus from the stoma was marked. The effect of glyceryl trinitrate lasted from 20 to 50

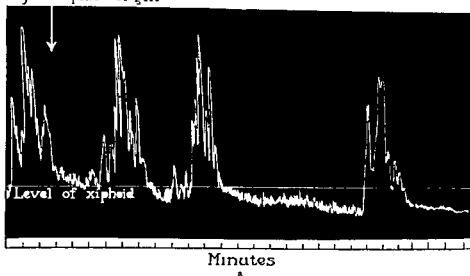
minutes (Fig. 1, c). The relatively evanescent action of the nitrites and the light-headedness which may follow their use, may be considered slight disadvantages in the use of these drugs.

Benzedrine Phenylisopropylamine (racemic desoxynor-ephedrine, racemic benzyl-methyl carbinamine) has been introduced in this country under the trade name "benzedrine."

Intramuscular administration of 20 milligrams of benzedrine sulphate has a somewhat variable effect on intestinal tonicity in different subjects observed. Administration of large doses, 40 milligrams, made very little difference. In general its action was manifested by some decrease of tone without impairment of peristaltic motility (Fig 2). It was noted occasionally that no change of tone was manifested and in 1 of 10 subjects on which its action was observed, there was a definite increase in tone of muscles. The duration of the effect of the drug on the muscle of the colon was from 40 to 90 minutes.

Detrick, Millekan, Modern, and Thienes found that in low concentrations (10^{-5} or 1:100,000) benzedrine salts had either no effect on excised smooth muscles of rabbits and guinea pigs or it inhibited motility. High concentrations (10^{-4} or 1:10,000) caused contraction of all excised smooth muscles.

Syntropan 01 gm



Trasentin

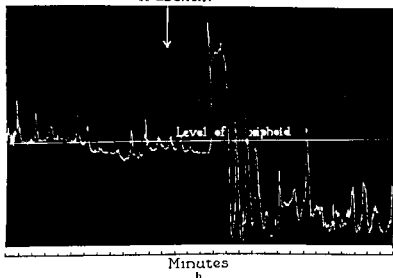


Fig 3 Decreased tone of the sigmoid colon a following intravenous injection of 0.01 gram of syntropan b following intravenous injection of 0.05 gram of trasentin c following intravenous injection of 1/100 gram of atropine sulphate

NON NARCOTIC ANTISPASMODICS WITH ATROPINE LIKE ACTION

Syntropan Many substances of a chemical constitution resembling that of atropine have been synthesized in an attempt to overcome

the undesirable side actions of atropine. Among these, one that has obtained some favor is the tropic ester of 3-diethylamino 2, dimethyl 2, propanol 1, which was introduced under the trade name "syntropan" (6). In

Atropine sulphate 1/100

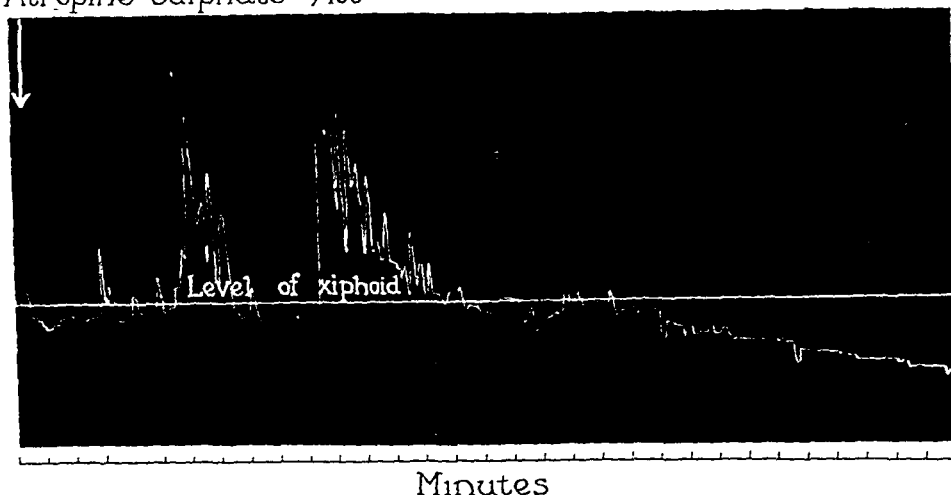


Fig 3, c

travenous administration of syntropan in doses of 0.01 gram had a depressing action on motility of the colon. Mydriasis was not noted in any of the 10 subjects on whom the drug was used. One patient complained of feeling hot, also of dryness of the mouth. In all cases investigated, there was some decrease in intestinal tonicity. The spasmolytic action of syntropan on the colon of man was found to be comparable with that of atropine, while its action on the pupil, salivary secretion, and vagus nerves was decidedly less than that of atropine (Fig 3, a).

Trasentin. The action of a new synthetic preparation, diphenylacetyldiethylaminoethanol hydrochloride was studied. This drug is known commercially as "trasentin" (7). It acted similarly to atropine but did not have the usual action of atropine on salivary secretion. Trasentin proved to be more effective than atropine in its spasmolytic properties. We found it more advantageous than some of the other drugs used, in that permanent suppression of contractions did not occur, and its spasmolytic effect was found to be easily removed by using some of the drugs which increase tone, such as pituitrin and prostigmin. Although tonicity was lowered, usually the frequency of rhythmic movements was not altered. The drug was administered intravenously, very slowly, in doses of 50 milligrams (Fig 3, b).

Atropine. The depressant action of atropine on the parasympathetic nervous system is well known. This action of atropine is made use of widely for therapeutic purposes (5). Its effect of decreasing the tone of the large bowel compared favorably in these observations with that produced by syntropan and trasentin but the undesirable features of dryness of the mouth, flushing of the skin, and blurring of vision make this drug less desirable. We gave the drug intravenously in doses of 1/100 grain (0.0006 gm.) with caution. As noted in Figure 3, c, intestinal motility was almost completely arrested. The undesirable side actions such as flushing of the skin, dryness of the mouth, and dilatation of the pupils were marked when the drug was used in sufficient dosage to obtain the desired effect on the smooth muscle of the colon.

SUMMARY AND CONCLUSIONS

1. A simple method of observing the relative effects of various drugs on intestinal tone of patients is described.

2. Of the spasmolytic drugs used in our study, glyceryl trinitrate and amyl nitrite were found to be the most consistently efficacious in decreasing the tone and lessening the irritability of the large bowel. However, certain obvious disadvantages impair their desirability, such as their evanescent action,

and the feeling of light headedness which they induce

3 In view of the fact that the administration of morphine increases the tone of the colon causing localized regions of the intestine to contract, it may be that the nitrites may have some value in postoperative distention

4 Our method of administering benzedrine even in large doses (30 mg intravenously) did not result in constant decrease of tone and decrease in tone was slight

5 Syntropan and trasentin are efficient antispasmodics, and had the effectiveness of atropine without undesirable side effects

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CLINICAL SURGERY

FROM THE SURGICAL CLINIC OF THE PETER BENT BRIGHAM HOSPITAL

THE SURGICAL PROCEDURE FOR TOTAL THYROIDECTOMY

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Boston, Massachusetts

TOTAL thyroidectomy was first suggested in 1932 by Blumgart, Levine, and Berlin, as a method for relief in certain forms of heart disease. It has been carried out for a great many disorders, unfortunately with little hope of relief in some cases. Indeed, the voluminous literature which has accumulated in the past 5 years concerning the effect of this procedure upon man is alarming, since one must be anxious about the continuous care these athyroid people receive.

Since it is poor therapeutics to create one pathological entity to help another unless there be certain hope of general benefit, and since the procedure has certain dangers, we describe here in some detail the procedure of total thyroidectomy as practiced at the Peter Bent Brigham Hospital in Boston. Our experience includes 77 cases operated upon between December, 1932, and March, 1937. We have had no case of permanent injury to the laryngeal nerve and we have had only one fatality which could be called a postoperative death in the sense that it was strictly related to the surgical ordeal. The operation is one of exactness and finesse rather than magnitude. The two great dangers are (1) injury to the recurrent laryngeal nerve and (2) parathyroid ablation sufficient to result in tetany. Both complications are obviated by a knowledge of anatomy and a bloodless field.

Pre-operative preparation. Since this operation is utilized most frequently for decompensated heart disease or angina pectoris, preparation will be aimed primarily at the cardiac condition and should be carried out in conjunction with an internist experienced in these disorders. If it is performed for other than cardiac conditions, the preparation will relate to the care of such other conditions.

Anesthesia. Morphine, in dosage sufficient to give comfort, usually 0.015 gram, should be given hypodermically one hour preceding the operation, and smaller doses may be repeated if necessary. Local anesthesia, preferably novocain 1 per cent,

is the ideal anesthetic. Adrenalin should not be added to the novocain solution because it may provoke painful and serious attacks in patients with angina pectoris. The chief danger in the operation is injury to the recurrent laryngeal nerve, and any anesthetic which abolishes consciousness and therefore prohibits phonation is undesirable.

Position. A comfortable semi-recumbent position with neck well flexed over a small pillow or sand-bag is preferable and is well tolerated even by dyspneic patients if they are first quieted by morphine.

Skin-preparation and draping. The draping varies according to the desires of the individual surgeon, but if the patient is dyspneic and irritable, as is common with severe heart disease, adequate ventilation beneath the draping is essential. We prepare the skin with alcohol, 70 per cent, and Albasol solution (5), secure towels to the skin with silk sutures adjacent to the outlined incision, and cover all with a sheet with an oval opening. The upper towel and the sheet are held well away from the face by a small table, the height of which is easily adjusted.

Incision and exposure. The usual horizontal collar incision is made 3 centimeters above the sternal notch and extends out onto the sternomastoid muscles. The incision appears almost transverse when the neck is flexed (Fig. 1). The incision should exactly enter the plane of loose areolar tissue between the platysma muscles and the pretracheal muscles. Exposure is completed by reflecting the skin flaps, including the platysma ribbon muscle up and down. This reflection is done partly by pushing the flap with a finger covered with wet gauze and partly by sharp dissection with a knife (Figs. 2 and 3).

Details of procedure. The prethyroid muscles are split in the midline, the incision being carried down to the thyroid substance. From this point, the muscles are separated by blunt dissection from the thyroid lateral lobes (Fig. 4). This is best done by elevating the muscles and freeing the

and the feeling of light headedness which they induce

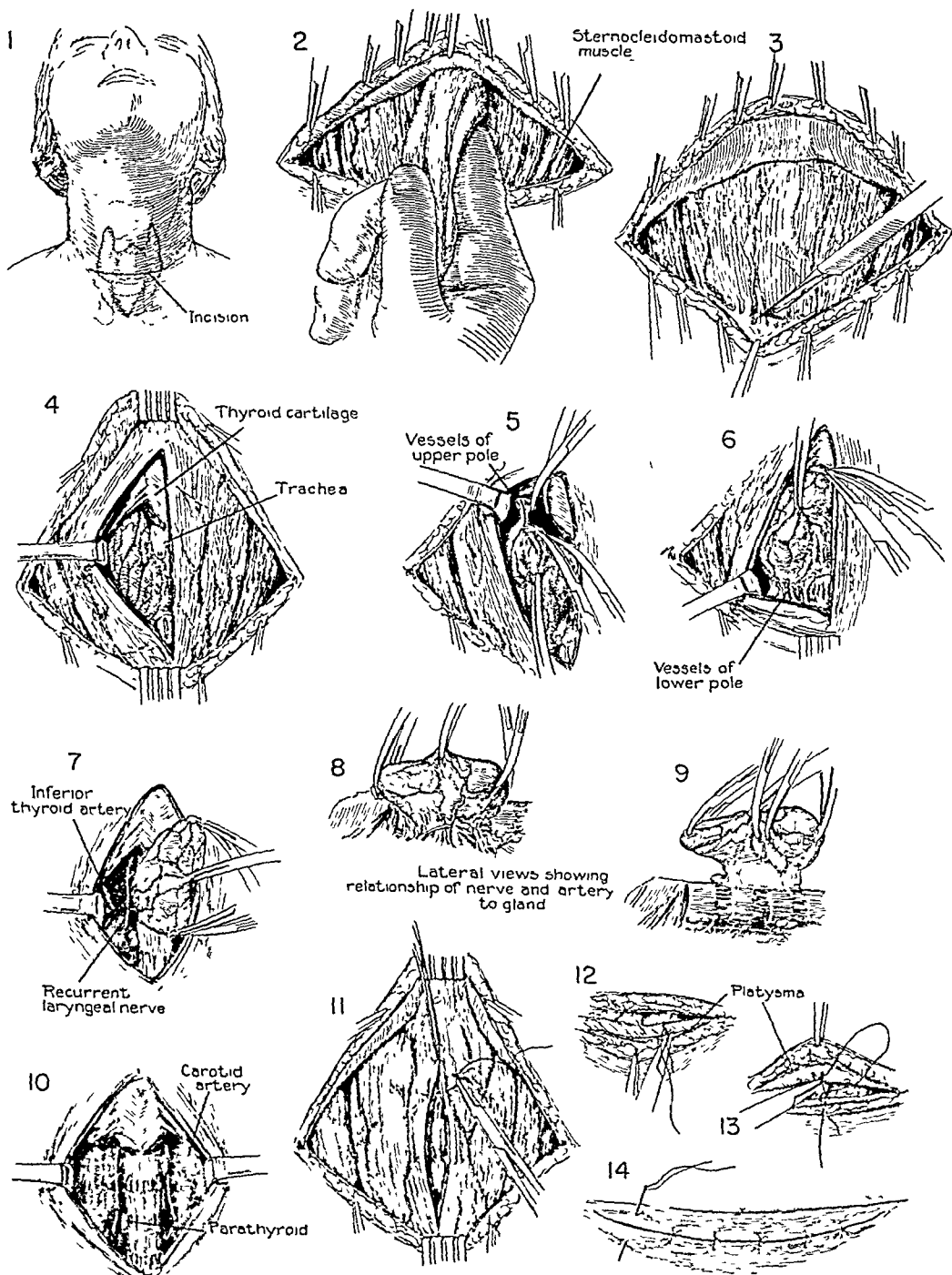
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Figs 1 to 14 Steps in removal of thyroid gland, fully described in text.

loose areolar tissue with a "joker" or pledgets of cotton wet with salt solution. When the outer border of the lateral lobe is visible, the two fore fingers may be inserted to a point beneath the thyroid gland and then separated until one finger reaches the upper pole and the other the lower pole of the gland, thus freeing the inferior surface of the gland. A narrow retractor is then placed in the upper angle of the wound and is pulled upward and outward to expose the upper pole. The mesial aspect of the upper pole is separated from the laryngeal region by inserting curved pointed hemostats and opening them. A curved hemostat is then placed upon the vessels which branch from the superior thyroid artery just as they enter the gland. This hemostat may be utilized to pull down the gland when a second clamp, or even two clamps if necessary, are placed upon the upper pole vessels above the capsule of the gland (Fig 5). The vessels are then divided and ligated but the hemostat on the upper pole itself should be left on the gland for traction purposes. When this has been done the retractor should be moved to the lower pole (Fig 6) and the lower pole lifted away from the trachea. This permits one to see the small vessels entering the lower pole which may be clamped and divided extracapsularly. With these vessels out of the way, the trachea is visualized, and one can proceed upward along the trachea and the posterior aspect of the thyroid gland clamping and ligating vessels extracapsularly. Eventually the recurrent nerve will be seen passing through a bifurcation of the inferior thyroid artery (Figs 7 and 8). Both of these branches must be divided between clamps in the area between the nerve and the capsule. When this is done and these vessels are tied the nerve and the now unsupported vessel will drop back into the tracheo-esophageal groove (Fig 9). Considerable care must be taken just at the point where the recurrent nerve enters the larynx for here a tongue of thyroid substance protected by a thickening of the capsule of the gland runs down into the tracheo-esophageal groove. It may give comfort to those contemplating this operation to know that in our experience the recurrent nerve has always lain outside the thyroid capsule which position is to be expected on embryological grounds. Furthermore, if the surgeon is in doubt about the position of the recurrent nerve and does not soon find it with the inferior thyroid artery, he should go to the lower limits of the wound and identify it on the deep plane of the neck at the level of the lower border of the thyroid gland. Here it lies some 2 or 3 centimeters deep to the gland. By following the nerve upward, he can

divide the branches of the inferior thyroid artery without danger to the nerve.

Finally, the operator should early accustom himself to the appearance of the parathyroid glands which are pinkish chocolate colored nodes about 2 by 3 millimeters in size. The superior glands are usually found on the posterior surface of the gland at about the level of the lower portion of the thyroid cartilage and the inferior glands are seen at the lowest point of the gland usually underneath the inferior pole or lying in the fat a little below and deeper than the thyroid substance. As a rule, the inferior parathyroids are seen and can be left behind at the time when the small inferior vessels are first divided (Fig 6).

With the right lobe turned upward and away from the trachea, it is easy to separate the isthmus, and if there be a pyramidal lobe it is easy also to separate this from the midline. It is essential that all thyroid substance be removed and even the smallest pyramidal lobe must be followed to its limits. It is imperative at this point that the operator shift from the right of his patient to the left so that he may personally have the optimum visualization of the recurrent nerve while carrying out an exactly similar procedure on the left lobe. Figure 10 represents a field after both lobes have been removed and visualizes an upper and lower parathyroid body, the now uncovered recurrent nerves and no thyroid substance. We consider it unsafe to perform the operation of total thyroidectomy without adequate visualization of both recurrent nerves and with any anesthetic other than novocain 1 per cent which permits the surgeon to test for injury to the recurrent nerves as the operation progresses.

When the thyroid gland has been removed a meticulous search must be made for adherent parathyroid glandules. Questionable tissue must be submitted to frozen section study and if parathyroid substance is found it must be transplanted into a nest, preferably in the sternomastoid muscle. We have both human and animal experience to prove that such transplants remain viable and useful (3 and 4).

Closure. The retractors are removed the wound made perfectly dry, and the wound closed in layers without drainage, preferably with fine silk sutures. Figure 11 represents closure of the pretracheal muscles. Figure 12 represents the bringing together of the skin flaps utilizing the platysma muscle for this step. Figure 14 represents the ideal closure for a perfect wound by the use of fine silk skin sutures. These should be tied loosely so that the circulation is not jeopardized.

SURGICAL REPAIR OF THE LONG-DISABLED HAND

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THE purpose of this paper is to point out some details in reconstructive surgery which may be helpful to those who are called on to deal with the disabled hand.

It is an intensely interesting and I may say difficult task, to attempt to salvage a hand which has been crippled for a long time. One must have courage, for the beginner will have many disappointments, even the experienced will at times be disheartened. But there are compensations as well.

We are distinguished from other animals by our hands and their ability to oppose thumb to fingers. The chief function of the hand, of course, is grasping. But aside from its utilitarian aspects, the hand should be considered from the standpoint of appearance. The hands and the face are the only two parts of the body which are constantly in view, and it is not surprising that a malformed hand may cause as much mental anguish to an otherwise attractive young woman as a disfigured face. The hands can be covered with gloves, but even this fails if the fingers are so poorly formed that a glove will not fit.

The two motivating desires then which bring the patient with a crippled hand to the surgeon are, first, the wish to have a more useful hand, and second, a better looking hand. The former should, of course, outweigh the latter in importance, especially from the surgeon's point of view. And from experience, I have found that a patient will very rarely forgive lessening of function which has come about from trying to improve appearance. Fortunately, the two usually go together, if function is improved, then appearance is also.

Which hands can be salvaged? I know of no positive way to answer this question other than by experience, and there are some conditions in which one is, from the start, doomed to failure.

It is enough to know that in general one has much more chance of success if skin alone is involved in the deformity, than if joints and tendons are at fault. The hand contracted by scar, but with joints freely movable through a range limited by the scar, is usually reclaimable. The deformity due to long standing nerve or joint injury is not ordinarily favorable, and those with disability due to old tendon injuries lie about halfway between.

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The problem of reconstructing a hand is diametrically opposed to the restoration of the crippled foot. In the latter, one often annihilates motion to improve function, but as for the hand, motion is the essence of function. For the hand to function properly, there must be faultless motion of all its parts. A slight loss of motion in a finger, which would not be noticed in other joints, may cause infinite annoyance to its owner.

One should search one's conscience for the answers to the following when deciding whether or not a hand can be improved: Can the function of this hand be increased? Can it be done without danger of damaging the hand still further? What will the hand look like when I am through?

How to operate on the hand. Asepsis is the *sine qua non* for success in any operation on the hand. Here more than almost any place in the body,

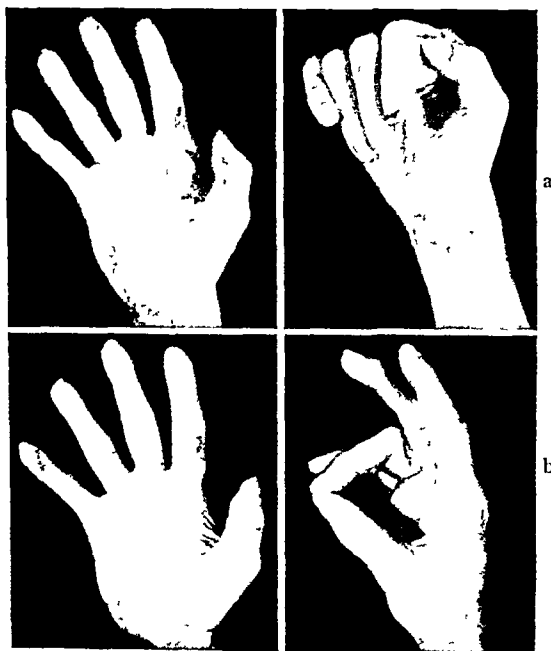


Fig 1. a, Flexion of terminal phalanx of thumb in flexion, 5½ months after radical drainage of sheath of thumb flexors and radial and ulnar bursa. b, Good position of phalanx for opposing action 6 weeks after operation at which flexor tendon was dissected free from scar and collateral ligaments of terminal joint divided.

and should roll the skin flaps up to a little mound at the lips of the wound. Such sutures can be and are best removed in 56 hours.

Postoperative care. There is no reason why such patients should not be fed and be given water as soon as desired. Hoarseness and possibly aphonia may occur as a result of injury to the recurrent laryngeal nerves. Although hoarseness appeared in a few of our cases and persisted for varying periods of time, aphonia was not encountered. There is no specific therapy for this complication other than the usual measures, such as inhalations.

Tetany was an infrequent complication which appeared within 4 to 14 days after the operation. The symptoms and signs of tetany in these few cases were mild, such as stiffness of the hands, paresthesia, and muscular weakness. Trousseau's sign was invariably positive when tetany developed but Chvostek's sign was found to be less reliable. The symptoms were readily and permanently controlled by the administration of from 5 to 10 drops of viosterol and 4 to 8 grams of calcium lactate daily for a period of from 2 to 3 weeks (2).

The patients were allowed to become ambulatory at varying periods after operation, depending upon the degree of cardiac decompensation at the time of operation and the rapidity of the circulatory response to the removal of the entire thyroid gland. The postoperative convalescence

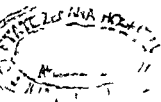
was necessarily longer for the patients operated upon for the relief of congestive heart failure than for those with angina pectoris.

The typical symptoms and signs of myxedema develop within a period of 4 to 8 weeks after operation. It has been found desirable to keep the basal metabolic rate at a level of about minus 20 (2). Smaller doses of thyroid extract were necessary to produce the same effect in surgical myxedema than in the spontaneous type.

Finally, the postoperative care should be devoted entirely to the patient's original condition for which the operation was performed.

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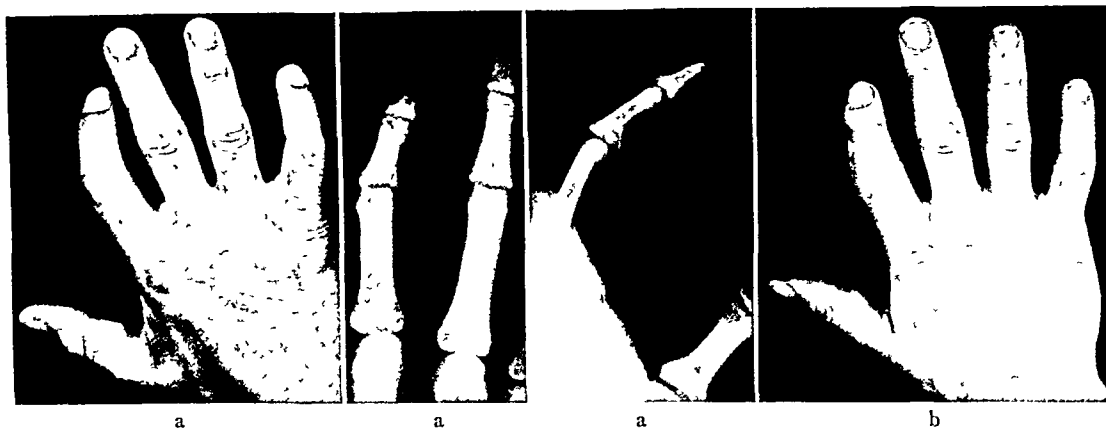
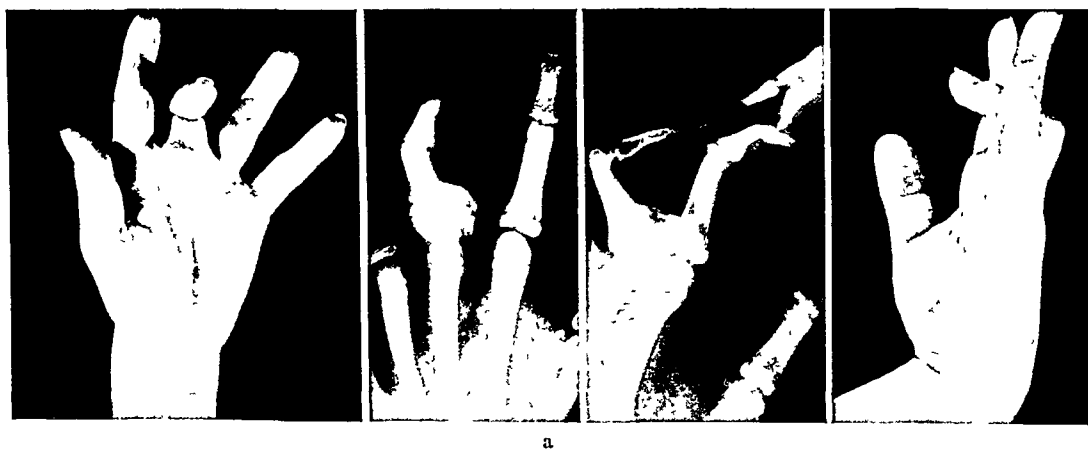
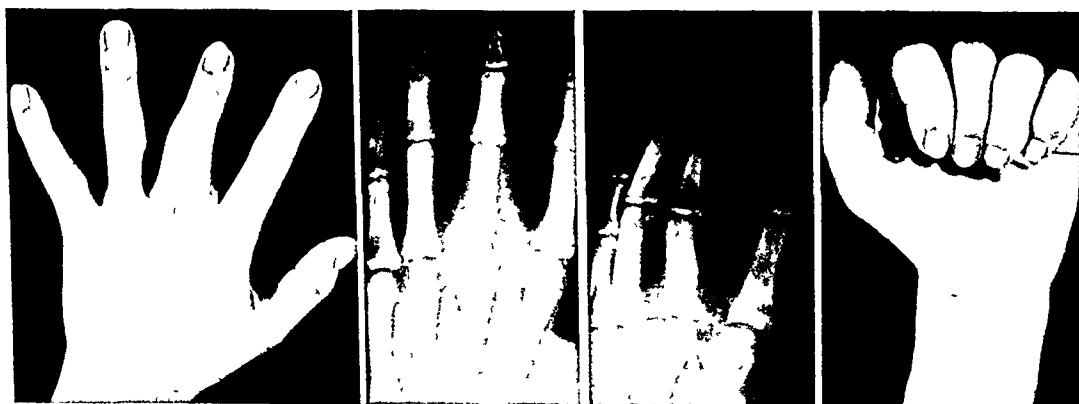


Fig 4 a, Crooked index finger with loss of motion in proximal interphalangeal joint due to a 2 month old intra-

articular fracture b, Following arthroplasty the finger is straight, but there is no gain in motion



a



b

Fig 5 a, Limitation of extension of middle finger due to a large exostosis—duration 15 years b, Following

excision of exostosis there is complete function of the finger, except for 10 degrees' limitation of extension

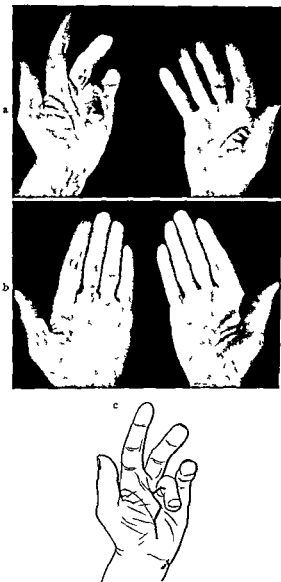


Fig. 2 a Dupuytren's contracture of ring finger of left hand and beginning of same in middle finger right hand b Complete correction 1 1/2 years after operation c Staggered incisions through which the fibrous aponeurosis was removed skin gap in palm of left hand closed by rotating a flap from the thenar eminence

infection leaves in its wake extreme disability. We are all familiar with the "frozen" hand which infection of the tendon sheaths leaves behind. It is then no wonder that some men spend a number of days in preparing the hand for operation. I

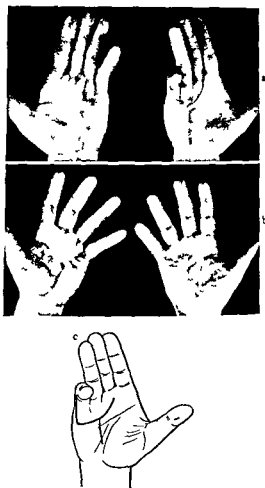
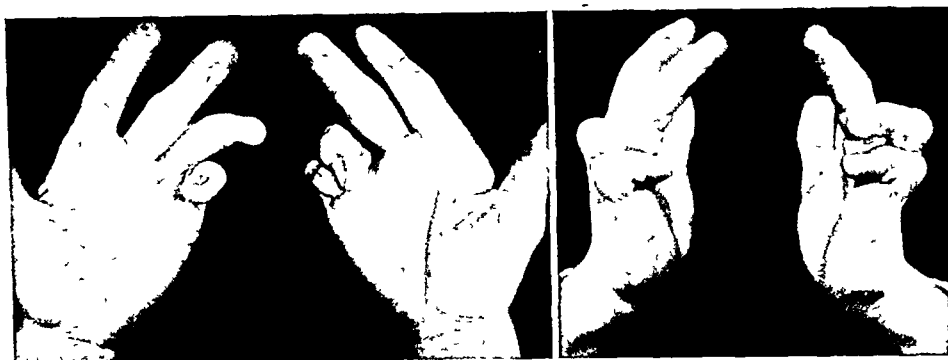
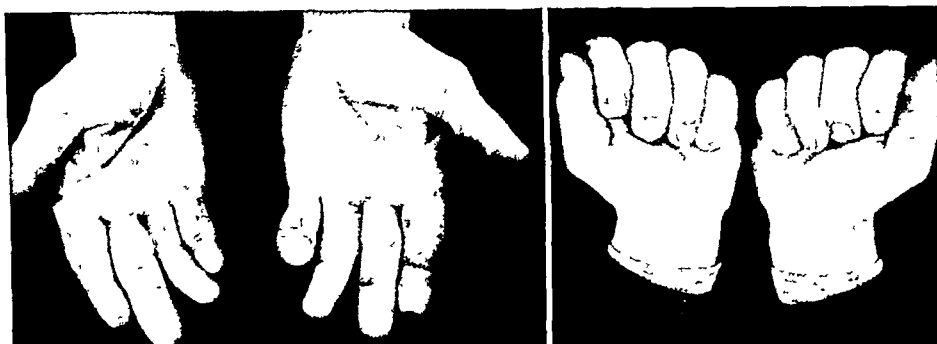


Fig. 3 a Dupuytren's contracture bilateral b Result 3 months after operation on right hand c The staggered incisions used

have not felt that scrubbing and applying antiseptics to the hand for 1 or 2 days before operation adds any appreciable amount of safety, except in the occasional case. It is far more imperative to recognize that the most important single factor in postoperative infections of the hand is the character of its integument. If we remember that the palmar skin is actually dead, horny epithelium from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch thick in most hands and that in the hand of a manual laborer it becomes double this in thickness, it is not difficult to understand why it heals poorly in the upper layers, macerates and offers a place for the ever-present skin bacteria to gain a foothold. In the office worker, one rarely has much trouble with incisions

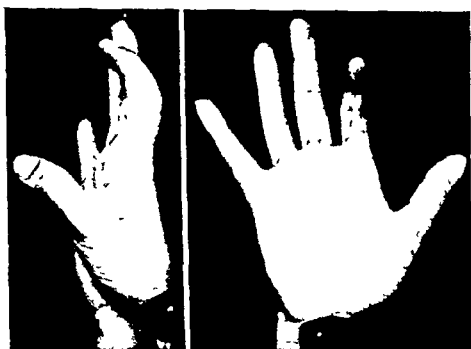


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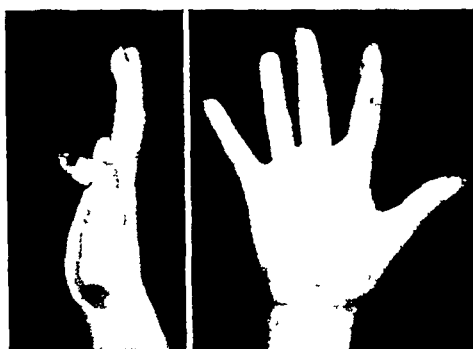


b

Fig 7 a, Flexion contracture of ring and little fingers both hands Cause—scar contracture following operation for syndactylism in infancy b, Result of releasing contractures and constructing volar surfaces of fingers with free full thickness skin grafts



a



b

Fig 8 a, Flexion contracture of index finger due to laceration 14 years previously b, Result following release of scar and filling in gap with free full thickness skin graft

ated The muscle over a period of time shortens to its new position. Thus if operative repair is attempted a few months after injury there are a number of serious obstacles to be overcome The

proximal end of the tendon can be found but it is usually high in the palm and may even have to be sought for in the wrist After the tendon has been freed from whatever attachments it has

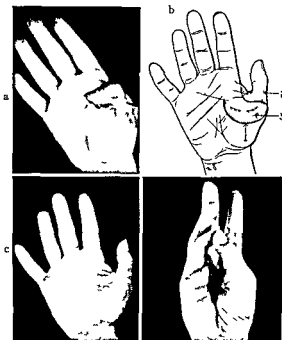


Fig 6 a Useless thumb due to flexion contracture following trauma b Scar tissue released. Defect filled by swinging flap 1 to position 2 and covering area from which flap came with free full thickness graft 3 c Appearance of thumb 5 months after operation d Function good

in the palmar skin healing cleanly and promptly. In the manual laborer, it is sometimes wise to 'skin' the hand with soaks over a period of days, allowing a few days between this procedure and operation for the softened epithelium to peel off.

I no longer use a tourniquet or blood pressure cuff to render the hand ischemic. It is true that it is easier to operate under bloodless conditions but if the hand and arm are palsied for 2 or 3 months following the application of a tourniquet for an hour, one is not likely to continue with the same technique. By taking one's time a good dissection with complete visualization of the digital nerves and vessels can be done without a tourniquet and without danger of damaging these important structures.

I hold no brief for any antiseptic. A more important step in preparing the hand for incision is that it be thoroughly cleansed with sterile soap and water for 15 to 20 minutes followed by rinsing with alcohol and ether. After this any antiseptic can be used.

Incisions in the hand as is well known must be made with thought as to the structures under

neath and, moreover, with an understanding of the end stages of scar contracture and its effect on function. For these reasons incisions on fingers are never made on dorsum or palmar aspects in the midline. On the volar surface particularly, such incisions as the scar contracts, will invariably pull the finger into a flexion contracture. Therefore, longitudinal incisions are made laterally. As the phalangeal joints have very little motion in this direction contraction of the scar does not result in deformity. The digital arteries and nerves are lateral and from such an incision can easily be found and kept out of harm's way. In the palm, incisions should follow flexion creases whenever possible and be staggered. This prevents contraction in only one plane and leaves as nearly as possible, normal close attachment of palmar skin to underlying structures which is of importance in the grasping function.

Bleeding must be accurately controlled and the operative site left as nearly bloodless as possible. A hematoma under skin invites infection, and if this does not occur, produces by its absorption a sheet of scar tissue which leaves the hand stiff for a long time. Ligature material should be split silk as it produces less reaction than catgut and, therefore, less disabling fibrous tissue. Capillary oozing is controlled by using an elastic pressure dressing (marine or rubber sponge). Skin sutures are left in longer than in most incisions because in the palm the skin edges heal slowly, and the holding power of the sutures is needed. For this reason horsehair is the skin suture of choice since it can be left in a long time with very little irritation.

Repair of tendons. The repair of tendons which have been deranged for a long period of time is an entirely different problem from that of restoring a tendon immediately after injury.

The flexor and extensor tendons to the fingers, when severed can in a high percentage of cases be satisfactorily reconstituted immediately. There are certain fundamentals which must be observed to attain such results. These have been brought out over a period of time by Bunnell, Koch, Kanavel, Mason, Mayer and others. However at least in my experience the prognosis is nowhere nearly as sanguine if the severance has occurred a few months or longer before repair is attempted. When a deep or superficial flexor tendon is severed in the finger, the proximal end, due to muscular pull immediately retracts upward a considerable distance. In this new position it becomes adherent to the sheath as blood clot and inflammatory reaction subside. The sheath between the two ends collapses and may become obliterated.



Fig 10 a, Lateral contractures of thumbs and flexion contracture of all fingers except index, cause—burn in infancy b, The hands 1 year after releasing contractures and filling in where necessary with split grafts One operation on each hand

There is another type of long disabled hand which the surgeon interested in these problems often sees This is the hand in which a severe infection of the tendon sheaths leaves fingers stiff and more or less useless We all know from experience that, if drained early, a fair proportion of the flexor tendon sheath infections will clear, leaving a perfectly normal hand But these patients do not always seek medical advice until tendon sheaths and both radial and ulnar bursæ are involved And in these hands there is a great residual of disability It is in most instances due either to complete sloughing of a segment of tendon, or to firm adherence of tendons to sheaths There may be fixed flexion contractures of fingers due to adherence in the flexed position

In loss of tendon from this cause, grafts can be done to re-establish continuity but one must not be too eager to embark upon this undertaking The scar must have completely softened and preferably a year or two elapsed since infection

Adherence of tendons in contracted positions can be corrected by tenotomy and tendon lengthening Usually it is necessary to do a capsulotomy of the affected joint It is hardly ever worthwhile in these cases to do a tendon lysis There will merely be firm readherence of the tendon to sheath It is much better to use massage and stretching over a prolonged period of time By

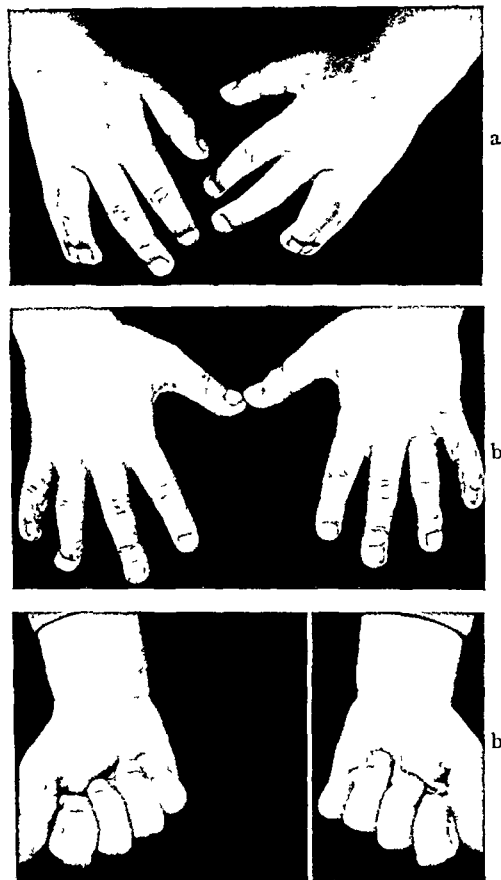


Fig 11 a, Syndactylism of ring and little fingers b, The hands 1½ years after correction Webs made with flaps from dorsum of fingers opposing surfaces of fingers covered with thick split grafts

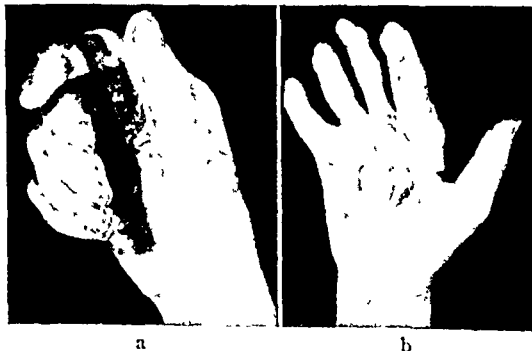


Fig 12 a, Flexion contracture of all fingers following burn b, Complete extension of fingers following release of scar and construction of palm and proximal volar surfaces with glove-shaped free full thickness graft

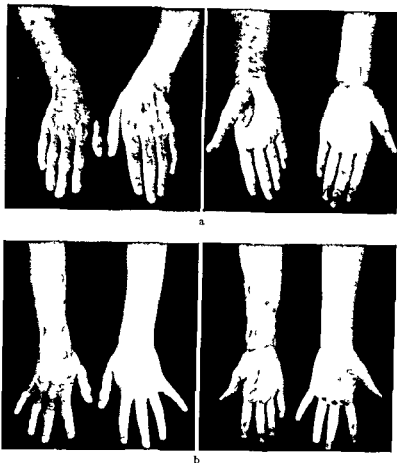


Fig 9 a An embarrassing hairy nevus on the forearm of a 14 year old girl b Result following removal in 3 operations Dorsum resurfaced with free full thickness grafts volar aspect with one large split graft

made, the gap between the two ends is usually so great due to muscle shortening that it can be bridged only by a graft. For this purpose I have tried fascia lata strips and portions of the peroneus tertius but have never had any marked success with either. The graft undoubtedly persists—but as there is usually no sheath it probably becomes adherent to surrounding structures and is unable to function. Louis Mayer has inserted celloidin tubes some months before in an attempt to form a sheath, in which the graft may be placed. This may be an answer. At least it recognizes I believe the fundamental difficulty in reconstituting a tendon in which a gap has existed for some time. All in all more can usually be expected from tendon substitutions than from tendon grafts. I have a number of times attached

the distal stump of a deep flexor to an intact superficial flexor and vice versa and although one cannot expect normal function there is usually worthwhile improvement.

In dealing with old interruptions in continuity of extensor tendons one does not encounter as many difficulties. Usually the proximal end does not retract as far. This is true particularly of injuries distal to the dorsum of the hand where the tendons are attached to bone and to one another by transverse fibers. Because they are more superficially located they are more easily found. These gaps can often be bridged without recourse to grafts. And because the sheaths are not so well developed distal to the middle of the metacarpals the re-establishment of them is not so essential a factor.

some individuals be very disabling and such patients often consult the surgeon.

A damaged interphalangeal joint is a very difficult problem. I have done a number of arthroplasties on such stiffened joints and must say that the increase in motion has never been great and in some was nil. The usual procedure has been to place fascia over the refashioned articular surfaces and in those instances where only one surface of the two opposing cartilages has been damaged to leave bone moving on cartilage. I have recently thought of placing a piece of rib cartilage over the shaped bone—but experimental failures in dogs where rib cartilage has been transplanted into the articular surfaces of the knee joint have deterred me.

The reasons for failure go deeper than the material used for articular surfaces. These joints are small. They are difficult to get at surgically without doing damage to important structures. The trauma which is inevitable produces a marked inflammatory reaction with subsequent fibrosis of peri-articular structures. It is probable that these articular surfaces must be reproduced exactly to allow all the finer aspects of phalangeal motions. This is a most difficult thing to do. I therefore have come to feel that in my own hands, in spite of some sanguine reports in the literature to the contrary, arthroplasty of interphalangeal joints is rarely indicated and that more can usually be accomplished by prolonged physiotherapy.

Repair of skin. The covering of the hand calls for replacement when it has been lost, and when correcting contractures due to shortness of skin.

The skin on the dorsum of the hand has practically no subcutaneous tissue, and that of the palm very little. The two differ in that the dorsal covering is loosely attached and freely movable over underlying structures, while the palmar skin is rather tightly attached to the palmar aponeurosis, especially at flexion creases. To simulate these conditions as nearly as possible should then be the aim in replacing hand skin.

All in all, free skin grafts probably meet these needs better than pedicle grafts. The so called "pocket graft" from the abdomen for either dorsum or palm of the hand causes an unsightly

appearance, and in the palm, functions poorly. Ordinarily, it is transferred with a great deal too much subcutaneous tissue and leaves a hand looking like a boxing glove. This can be corrected if one, some months after final transfer, lifts the transplant at two or more sittings, and removes excess fat. And for the dorsum, this is a satisfactory plan, but even this in the palm leaves a loosely attached skin which wrinkles and pinches with grasping, and functions poorly.

Free transplants on the dorsum are indicated if the extensor tendons are not exposed. Within a few months after grafting, they become soft, pliable, and durable. I have transplanted free skin directly over muscle in both lower arm and leg, and within a few months after motion has been allowed, have seen the skin attachment to muscle gradually come loose, so that the muscles function underneath it without pull, as in the normal extremity. There must be some building up of a subcutaneous tissue of a sort under these grafts.

In the palm, the only disadvantage to free transplants is their relative thinness. But in one who does not do heavy manual labor, they are durable enough for ordinary wear and tear. They have an advantage in that they remain tightly adherent to their base, as the moving structures are situated more deeply under the aponeurosis.

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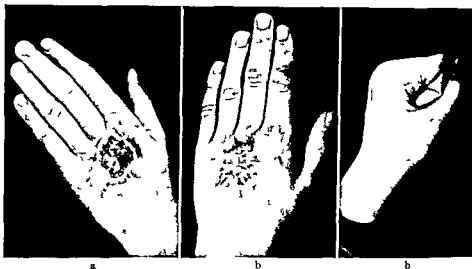


Fig 13 a Traumatic loss of skin from dorsum of hand b Completely normal function following restoration of lost area with thick Thiersch graft

these means, a slow but definite gain in motion can usually be obtained

Loss of continuity of tendons occasionally occurs spontaneously. The tendons most frequently involved are the extensors to the thumb. These are usually relatively simple problems. They fall more in the class of immediate repair of a severed tendon. The disability is noted at once and advice is sought. The ends are easily found and approximated. The sheath is normal and can be reformed. Function following such a procedure should be normal.

Contracture of fascia. In Dupuytren's contracture the fundamental fault of course is fibrosis, hypertrophy and contracture of the palmar aponeurosis and its digital slips. This process is usually quite slow so that over a period of years the fingers are drawn into flexion. It has always surprised me that with such a gradual contracture the flexor tendons and the joint capsules do not become shortened. But such is the case. There is rarely any difficulty in bringing these fingers into full extension once the fibrous bands are removed. This is also true in flexion contractures due to skin losses. I have never lengthened a flexor tendon in such an instance although often the joint capsule is so shortened that the collateral ligaments must be divided. However in a Dupuytren's contracture of long standing and severity it is usual to find that the skin has contracted so that when the fingers are fully extended there is a gap in palmar covering which must be filled in with a graft. Contrary to some reports I have not had trouble with Dupuytren's contractures recurring. Some of these patients have been followed for as long as 3 years, and there has been no return of deformity. If the fibrous aponeurosis is completely removed, if hemostasis is complete, if skin gaps are grafted and the fingers immobilized in extension during the healing period then there should be no recurrence.

Joints. The metacarpophalangeal joints are often stiffened by trauma and infection. Even slight limitation of motion of a finger may to

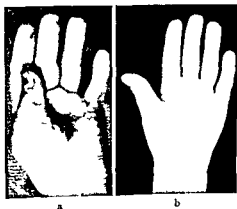


Fig 14 a left Contracture of thumb and little finger 2 years after traumatic loss of palmar skin b Ten months after release of scar and reconstruction of palm with thick split thickness skin graft

of the sphincter A simultaneous contraction of the gall bladder and of the choledochal sphincter, producing increased pressure within the bile ducts, and pain and distress, has been designated as biliary dyskinesia (13, 19, 32) Such a disturbed physiology can explain the severe symptoms which often accompany a very mildly diseased gall bladder

Spasm of the sphincter of Oddi is considered to be an important factor in postcholecystectomy pain and dyspepsia (2, 3, 9, 18, 29) A hyperirritability of the sphincter, due to a visceromotor disturbance and producing biliary dyskinesia, has been described as a possible sequela of cholecystectomy (31) Best and Hicken (2) refer to biliary dyssynergia as a physiological obstruction of the common bile duct If postcholecystectomy pain is to be explained on the basis of disturbed physiology alone it presents a difficult therapeutic problem.

LOSS OF TONUS OF SPHINCTER OF ODDI

Removal of the gall bladder is followed by an alteration in the function of the sphincter of Oddi and by dilatation of the choledochus In the dog these results have been variable By transplanting to the surface of the abdomen segments of the duodenum, containing the intramural portion of the choledochus and the ampulla of Vater, direct observations of bile flow were made possible (23). The fasting animal with an intact gall bladder did not discharge bile until stimulated by food Cholecystectomy caused a loss of sphincter tonus and a more or less constant flow of bile Further proof of the loss of sphincter tonus was the marked drop in the intraductal pressure, determined by catheterization of the duct However, this loss of sphincter tonus and reduction in intraductal pressure after cholecystectomy is not a constant finding in the dog Rost found it to be true in some and not in others, referring to them as "continent" and "incontinent" animals Potter and Mann noted an increase in intraductal pressure following cholecystectomy

In the human, however, a more constant drop in intraductal pressure has been recorded after removal of the gall bladder Figures have varied, depending upon whether measurements were taken from the level of the abdominal wall or from the approximate level of the choledochus Intra-abdominal pressure must be taken into consideration in determining these findings Both Wagoner and Salkin found a slightly negative intraperitoneal pressure. This was especially true in thin or emaciated individuals In obese persons the intra-abdominal pressure was frequently posi-

tive. Considering the fact that most patients with biliary tract disease are slightly obese, it is apparent that intra-abdominal pressure will maintain the bile column in a manometer recording intracholedochal pressure at or slightly above the level of the abdominal wall Butsch, McGowan, and Walters found the pressure measured by a column of fluid to be ordinarily between 0 and 20 millimeters of water above the level of the abdominal wall Doubilet and Colp state that the normal common bile duct sphincter resistance is about 150 millimeters of water They took their readings from the level of the duct, which they found to be about 120 millimeters below the surface of the body

Intraductal pressures have been determined in a majority of a series of 85 patients upon whom I have performed cholecystectomy and choledochostomy Two methods were used, a manometer was attached directly to the T-tube, and the height to which the bile column rose was noted at frequent intervals By this method the sphincter was not disturbed by the sudden pressure of a column of water forced through it The other method was similar to that used by Butsch and McGowan. In all of these patients, after sufficient time elapsed to permit the ducts and the sphincter of Oddi to recover from the trauma and edema incident to the instrumentation at the time of operation, the intraductal pressure was found to be at the level of the abdominal wall or but a few millimeters above it When it is necessary in searching for stones in the lower end of the choledochus to pass scoops repeatedly through the intraduodenal portion of it we expect a certain degree of swelling to follow This temporarily may obstruct the passage of bile into the duodenum, and will give elevated pressure readings It accounts for the large amount of bile which drains through the T-tube for a few days after operation and is one of the chief reasons why a common duct should be drained after exploration This swelling usually subsides in a few days, after which the intraductal pressure remains at about the level of the abdominal wall and the amount of bile draining through the T-tube diminishes These studies and those of other observers indicate that cholecystectomy is followed by a loss of tonus of the sphincter of Oddi. I believe this loss of tonus is responsible for the relief of symptoms following cholecystectomy in patients with a good gall-bladder history but with a minimum of pathological findings

Recurrence of symptoms referable to the biliary tract has been attributed to a return of function of the sphincter of Oddi The suggestion has been

CHANGES IN INTRACHOLEDOCHAL PRESSURE FOLLOWING CHOLECYSTECTOMY

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FEW therapeutic procedures produce satisfactory results in as large a percentage of patients as does surgery of the biliary tract. Numerous analyses (31) of extensive series of pathological conditions of the gall bladder and bile ducts treated surgically by competent men reveal cures or marked improvement in 80 to 95 per cent of cases. In spite of these good end results a skepticism is prevalent among laymen regarding the probable outcome of this type of surgery. Many people with gall bladder disease are of the opinion that an operation will be followed by a life of dyspepsia or more serious digestive distress. The resultant procrastination and delay of therapy frequently leads to complications or pathological changes in the liver and bile ducts which increase the hazards of surgery and lessen the expectation of a complete cure. This skepticism is shared by many physicians and may be instilled in patients by them. There are numerous reasons for this. A gall bladder operation which fails to relieve a patient presents the physician with a very difficult medical problem which is far more impressive than a dozen cures. Because of the difficulty in bringing relief to these patients much clinical and experimental investigation has been carried out and voluminous medical literature constantly reminds the profession of the unsuccessful results of biliary surgery. This is as it should be for it tends to stimulate more careful study and treatment.

Many factors have been considered as contributors to unsuccessful results in gall bladder and bile duct surgery. It is agreed however that poor selection of patients is the greatest offense. Autopsy studies reveal a high incidence of cholecystic disease in individuals who have had no clinical symptoms referable to it during life. Many other conditions may produce flatulence, dyspepsia, and distress which simulate gall bladder disease to varying degrees. This is especially true of the functional disorders including gastric neurosis, 'spastic colitis', 'nervous indigestion', etc. A co-existent pathological gall bladder may produce no symptoms and the re-

moval of it generally will not improve the patient and may aggravate his symptoms. The most important guide to the feasibility of biliary surgery is a good history. If there is a definite story of characteristic colics, with qualitative food distress, flatulence, and dyspepsia, a diagnosis readily can be made. Cholecystographic evidence is of considerable value, and the x ray report of a normally functioning gall bladder should delay surgery until, after a careful check of the history the surgeon is certain that he is dealing with biliary disease. If all histories are carefully obtained and surgery is avoided or delayed in the questionable group of patients, a large part of the failures of biliary surgery will be eliminated.

There will remain, however, a small group of patients who will continue to have characteristic biliary pain or colics after removal or drainage of the gall bladder or exploration of the choledochus. These have stimulated much thought and investigation as to the etiology and methods of relief of their symptoms. Properly to attack this problem it is necessary to have knowledge of the normal anatomy and physiology of the extrahepatic biliary system and of the changes produced by disease and by various surgical procedures. The existence of a separate body of muscle surrounding the distal end of the choledochus has been definitely established. Many anatomical studies have supported the existence of the sphincter of Oddi in the human and the recent studies of Schwegler and Boyden have shown its embryological development. That this muscle has a definite sphincter action in animals possessing a highly functioning gall bladder has also been established by many observers since the time of Oddi (17, 20, 21, 27). A sufficiently high pressure is maintained within the common bile duct to force bile into the gall bladder where it is concentrated. Stimulation such as is produced by the ingestion of food can cause a contraction of the gall bladder and a partial relaxation of the sphincter of Oddi thus permitting bile to flow into the duodenum. This action has been attributed to a contrary innervation of these two structures (10, 11). A disturbance of this mechanism is considered to be one of the etiological factors in biliary tract distress. Oddi mentioned the possible rôle of spasm

From Department of Surgery, University of Illinois College of Medicine, and the Illinois Research and Educational Hospital. Presented before the Western Surgical Association, Indianapolis, Indiana, December 3, 1937.

sphincter in the dog should permit duodenal pressure to be more easily transmitted to the common duct, yet when this is done the duct rarely dilates (6, 12). Also, it has been shown that a dilated duct will diminish in size after the sphincter is cut (6).

In man a number of arguments can be advanced against the theory that duodenal pressure transmitted through a patent orifice produces dilatation of the choledochus. If this were true we would expect duodenal contents to drain through T-tubes, yet this rarely occurs. Barium meals should find their way into the bile ducts and visualize them. This only occurs when a spontaneous fistula has become established or when a stone in passing through the duct orifice causes sufficient damage to permit regurgitation. Schwegler and Boyden's studies on the ampulla reveal valves which guard the orifice of the duct and prevent regurgitation of intestinal contents.

If the loss of tonus of the sphincter of Oddi following cholecystectomy is on the basis of a disturbed innervation, the same nervous derangement may conceivably cause a loss of tonus of the wall of the choledochus and a resultant dilatation. The small amount of muscle of this structure (3, 12, 16) is an argument against this theory. At present there is no satisfactory explanation of this problem.

EVALUATION OF STUDY

There is sufficient evidence to justify the conclusion that in the human with a normal biliary system the sphincter of Oddi functions to maintain an elevated intracholedochal pressure. Stimulation, produced for example by ingestion of food, causes partial sphincter relaxation and simultaneous contraction of the gall bladder. The studies here recorded suggest that cholecystectomy is followed by a marked and permanent loss of sphincter tonus. This can explain the relief of symptoms following removal of the gall bladder. Postcholecystectomy pain of true biliary origin is rare. It has been explained by a return of sphincter tonus. We know that certain factors can produce a spasm of the sphincter, at least temporarily. The administration of morphine will cause a rise of intraductal pressure for several hours (4). This drug causes an increased tonus of intestinal muscle and could also increase the tone of the duodenal sphincter. The work of Deissler and Higgins demonstrates spasm of the sphincter during anaphylaxis. Stones remaining in the bile ducts produce symptoms suggestive of sphincter spasm. Their presence may be indicated by jaundice, although frequently this is

not an associated symptom (15). Exploration of these patients often reveals stones, and all symptoms disappear after their removal. Crump has shown that stones are present in the choledochus in 24 per cent of individuals who possess them in the gall bladder. This indicates that many are overlooked at the time of cholecystectomy and may produce symptoms at a later date. In the series of patients operated upon by the author a number had had the gall bladder previously removed. Careful exploration revealed small stones in the cystic stump or bile ducts, and removal of them relieved the patients of the symptoms which were present.

Recently a few observers have recorded elevated intraductal pressure in some patients after cholecystostomy and have attributed this to spasm of the sphincter. However, many of their readings were taken too soon after operation for the traumatic edema to have subsided. Some high pressures were found in patients whose gall bladders were not completely removed. Dilatation of the choledochus does not occur to any great degree when the gall bladder is present even though it is diseased (24). It is possible that the sphincter in like manner does not relax under these conditions.

The foregoing considerations lead me to conclude that postcholecystectomy pain of true biliary tract origin is infrequent. When it occurs it is probably due to organic disease of the bile ducts, to stones within them, or to pathological changes in adjacent structures. A purely functional spasm of the sphincter of Oddi or a return of its tonus rarely occurs.

SUMMARY

Following cholecystectomy there is a dilatation of the choledochus and a permanent loss of function of the sphincter of Oddi. The latter is evidenced by a low intraductal pressure and can account for much of the relief of symptoms produced by this operation.

Good results are obtained in a great majority of biliary operations, but postcholecystectomy pain and distress are not uncommon. This is frequently the result of poor selection of patients. When of true biliary tract origin these symptoms can usually be accounted for by stones within the ducts or some other pathological condition and not by a primary disturbance in innervation producing sphincter spasm. A return of tonus or a purely functional spasm of the sphincter of Oddi rarely is a factor. Therefore, true biliary pain following cholecystectomy lends itself best to surgical therapy.

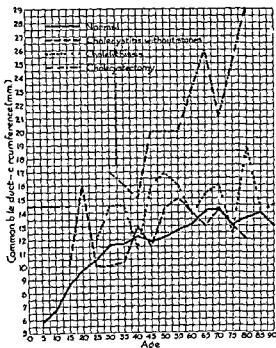


Fig. 1. A graph showing the average circumference of the normal choledochus and the effect of disease and cholecystectomy upon it. (From *Ann Surg*, 1935 101 602)

made that paralysis of this structure is only temporary. To determine if tonus does return to the sphincter of Oddi after its initial loss following cholecystectomy observations were made at varying periods after operation. T tubes were left in place up to 5 months but the intraductal pressure remained at the level of the abdominal wall. Pressure determinations were made in a number of patients in whom a choledochostomy was performed from 2 to 5 years after a previous cholecystectomy. In all of these patients there was no return of sphincter tonus. These observations lead me to conclude that removal of the gall bladder normally is followed by a permanent loss of function of the sphincter of Oddi. The cause of this change is not known. It has been attributed to the force of the secretory pressure of the liver undiminished by the absorptive power of the gall bladder. In this series of patients, however the sphincter was never subjected to much intraductal pressure because of the open T tube and sphincter tonus was lost before the T tube was clamped or removed. The theory has been advanced that cholecystectomy may produce an altered innervation of the sphincter, with resultant relaxation.

DILATATION OF THE CHOLEDOCHUS

A second result of cholecystectomy is dilatation of the choledochus. This likewise is not a constant finding in the dog. Rost found dilated ducts in dogs with long, powerful sphincter muscles, but non distended ducts associated with short sphincters. Judd and Mann found the extrahepatic bile ducts dilated after removal of the gall bladder. This enlargement did not occur if the duodenal sphincter was cut. Colp, Doubilet and Gerber found that cholecystectomy alone was followed by dilated ducts in only 8 of 20 dogs. When the sphincter was also cut only 2 of 12 dogs had dilated ducts.

Enlargement of the common duct after cholecystectomy is a more constant finding in man. The circumference of the choledochus was measured in 527 routine autopsies showing no pathology of the biliary tract (24). A curve according to age was plotted and the average adult circumference found to be 12.1 millimeters. Nine subjects were measured who had had a previous cholecystectomy but no history of jaundice. Each of these had a markedly dilated duct, the average circumference being 10.9 millimeters. It is interesting to note that very little enlargement of the choledochus accompanied untreated cholelithic disease (see graph).

Several explanations of this duct enlargement have been offered. After removal of the gall bladder with its absorptive powers and distensibility the entire secretory pressure of the liver is thrown against the walls of the choledochus. As this pressure is nearly twice that normally found in the common duct it could produce dilatation. This theory depends upon a persistence of action of the sphincter of Oddi after cholecystectomy. It is supported by the work of Judd and Mann and of Colp and his co-workers, who noted that the ducts rarely dilated when the sphincter was destroyed. It will not explain the choledochal enlargement in the human if the above recorded studies showing rapid and permanent loss of sphincter tonus are true.

A second explanation has been advanced by Bergh Sandblom and Ivy who state that pressure transmitted into the common duct from the duodenum as a result of incompetence of the sphincter may be an important factor in the production of dilatation in many instances. They base this conclusion on results of transplantation of the common duct into the duodenum. If the duct passes directly through the bowel wall dilatation follows but if it is introduced obliquely enlargement does not occur. There are a number of arguments against this theory. Cutting of the

"SUBDURAL" HEMATOMA

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HANNAH has recently stated that so called subdural hematomas are not truly subdural but rather occur in one of two places, first and predominantly, in the vascular or middle layer of the dura mater, or second, in newly formed membranes which have arisen in response to some previous disease process. It is with further confirmation of this theory that this paper deals.

While in the past few years many papers on this subject have appeared in the literature, those of Putnam and Cushing, as well as those of Leary, have been drawn on freely for clear descriptions and comments concerning the present accepted views on subdural hematoma. The material in the first part of this paper is therefore largely drawn from these authors. According to them subdural hematomas may be divided into two groups: spontaneous and traumatic. The so called spontaneous or vascular type of hematoma is found primarily in chronic wasting diseases, such as paresis, chronic and acute alcoholism, and so forth. The traumatic, or reactive form, is found chiefly following trauma, but it overlaps the first group somewhat as it may be found associated with certain of the conditions which have just been mentioned.

Although by no means the first to describe subdural hematoma, Virchow in 1857 brought this particular entity to the attention of physicians. He proposed the theory that in certain cases in which there was chronic inflammation of the dura, an exudation of fibrin took place. Into this thin film capillaries grew, which, under the influence of continued inflammation and hyperemia, ruptured and produced small hematomas, which in turn became organized. This theory has profoundly influenced subsequent workers, although much other work has been done and numerous other theories have been advanced.

Grossly, spontaneous types of hematoma vary from a series of small, discrete, and partially organized areas of hemorrhage on the inner side of the dura to large tumors which occasionally are bilateral. The most notable features of such hematomas microscopically are the mesothelium lined

rounded spaces, containing serum, debris, or fibrin, which are formed on the borders of the external surface of the clot. These spaces are usually small. The stroma is firm and fibrous. There is some pigment and a few leucocytes. Organization appears to be tardy and there are few new vessels formed. As time goes on a hyaline change takes place in the connective tissue of the dura and, after complete organization, calcification may occur.

The traumatic or reactive form of hematoma more frequently follows frontal or occipital blows than lateral blows as a result of the protective action of the falx in the latter circumstance (15). Even a slight blow on the face (4) or a fall without any apparent injury to the head may be sufficient to produce a hematoma (1, 7). The source of hemorrhage is presumably from the small veins joining the arachnoid to the dura, or from the longitudinal sinus. In cases of fracture of the skull with rupture of the arachnoid, blood may come from bleeding vessels in this structure.

Grossly, traumatic hematomas usually appear as an encapsulated mass on the inner surface of the dura. The contents may be solid, mixed, or fluid (12). The underlying arachnoid and pia mater may show some evidence of blood staining, as evidenced by their yellow to brown pigmentation. Microscopically such hematomas are seen to consist of well formed fibrous tissue, the cells of which are numerous, distinct, and have plump oval nuclei. The hematoma is sharply marked off from the dura and separates easily. Fibroblasts and vessels project into the clot. Numerous wandering cells, containing pigment and occasional leucocytes, will be noted. Interstitial hemorrhages may be present, capillaries may be numerous or scanty, and large, irregular, elongated spaces are present which lie parallel to the dura but separated from it by a layer of fibroblasts. These spaces have a mesothelial lining, the cells of which are sometimes plump and sometimes flat. These spaces usually contain erythrocytes and leucocytes, fibrin, and granular debris. They connect with the small vessels of the dura and with the capillaries of the organization tissue. They apparently gradually increase in size as time goes on.

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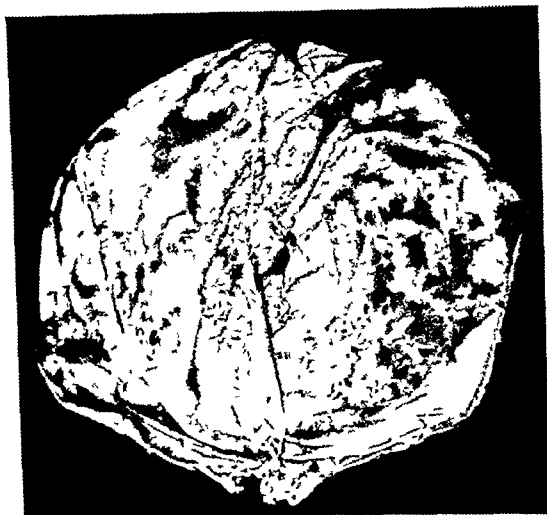


Fig 1 Bilateral multiple small hemorrhages

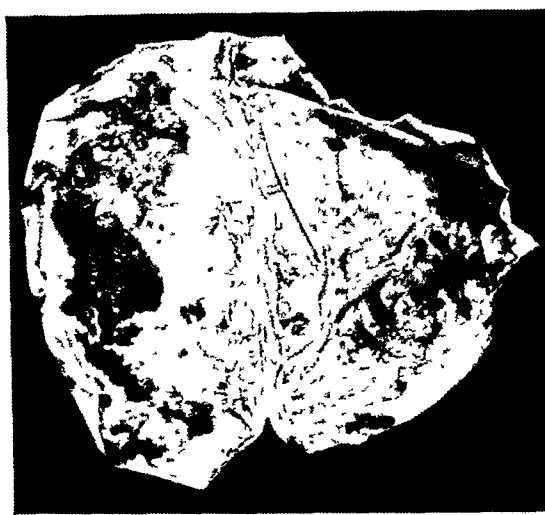


Fig 2 Bilateral multiple small hemorrhages and one larger hemorrhage

contents of the endothelial lined spaces, or the extent of destruction of blood, or alterations of the vascular supply. However, there did appear to be a slightly looser arrangement of connective tissue and, occasionally, increased hyalinization of the dura, as compared with uninvolved areas in the same specimen.

The 3 patients with spontaneous hematomas who had clinical and serological evidence of syphilis were all males and varied in age from 46 to 59 years. In 2 cases the lesions were bilateral, and in 1 unilateral. In 1 case the hematomas were small and more or less discrete, whereas in the 2 others, they were large and compressed the brain and contained 100 and 150 cubic centimeters of material, respectively.

Microscopic sections of these hematomas disclosed essentially the same picture that has been

described for the traumatic type. In 1 case there were multiple, small, perivascular collections of lymphocytes and plasma cells resembling miliary gummas, and in another, small areas of interstitial hemorrhage.

Of the 3 patients who had an associated blood dyscrasia, 2 were females, the 1 a male. Their ages varied from 48 to 63 years. A diagnosis of purpura hemorrhagica had been made in 2 cases, lymphatic leucemia in the third. In all these cases the hematomas were bilateral, in 1 case being large and in the 2 others consisting of conglomerate patches of intradural hemorrhage. Microscopically, it was again noted that the hemorrhages appeared to be intradural, and in the case of leucemia were accompanied by interstitial hemorrhage. All 3 showed small collections of lymphocytes, in the third case of leucemic origin.

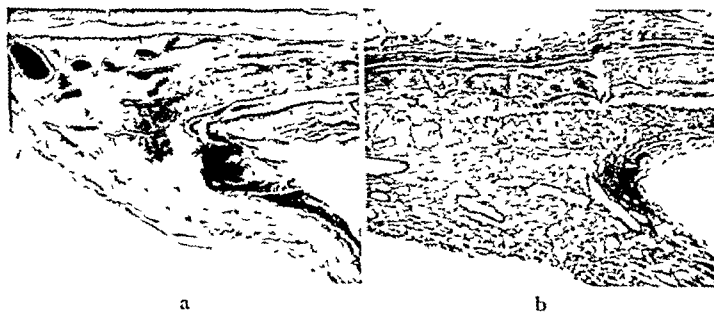


Fig 3 a, left, Endothelial lined spaces in the hematoma, spaces filled with blood, and b, thick meningeal layer, with empty endothelial lined spaces

The dura is a thick, dense, inelastic fibrous membrane which lines the interior of the skull and forms an internal periosteum of the bone. The dura has a rich blood supply and receives numerous arteries. In the anterior fossa there are branches from the anterior ethmoidal, posterior ethmoidal, internal carotid, and middle meningeal arteries in the middle fossa, branches enter from the ascending pharyngeal, internal carotid, and lachrymal arteries and the posterior fossa receives branches from the occipital vertebral ascending pharyngeal, and middle meningeal arteries. The veins, with the exception of the middle meningeal vein anastomose with the diploic veins and empty into the sinuses (2).

According to our studies and those of Hannah the dura consists microscopically of three layers. The outer layer which lines the skull is composed largely of dense fibrous connective tissue; it is in this layer that the large vessels course. The inner layer consists likewise of fibrous connective tissue, but in a somewhat looser arrangement than the outer layer. This layer apparently has a scanty blood supply. It is lined with a thin flattened layer of fibroblastic cells (8). The middle layer, with which we are most concerned, is composed largely of loose fibrous connective tissue in which there are many small vessels and numerous endothelial lined spaces which may be empty or which may contain blood cells (Figs. 1 and 2).

MATERIAL STUDIED

Thirty postmortem specimens of so called subdural hematomas were studied. Thirteen of the hematomas were of the traumatic type and the 17 remaining were of the spontaneous type. In these 17 cases there was no coincident disease in 11 cases, there was serologic or clinical evidence of syphilis in 3 cases, and in the 3 remaining cases the hematoma was accompanied by some form of blood dyscrasia.

In the traumatic group the ages of the patients varied from 14 to 73 years. There were 11 males and 2 females. On reviewing the clinical history it was usually possible to establish definitely the duration of the lesion. The hematomas were unilateral in 9 cases, bilateral in 4. They varied in size from one extensive hematoma which had compressed the brain to only a small area of hemorrhage. In both cases the hematoma was enclosed by a membrane. In most of these 13 cases the hematoma was at the vertex. In 1 case however, the hematoma was situated at the base and lateral aspect of the skull in the distribution of the right middle meningeal artery, and in a second case areas of hemorrhage were distributed

from the region of the occipital poles to the cribriform plate of the ethmoid bone. The pia mater, arachnoid and surrounding dura mater showed an increase in pigmentation in the case of older lesions.

Microscopically, and even in the case of most recent hemorrhage the clot was enclosed by a membrane which appeared to be the inner layer of the dura (Fig. 3). The degree of organization of the clot roughly increased with advancing age up to 2 to 3 months by which time all organization appeared to be of about an equal degree of maturity (Figs. 1, 2, 3, 4 and 5). Pigment laden phagocytes were noted in those cases in which there was evidence of erythrocyte degeneration. The endothelium lined spaces mentioned by Putnam were noted in all cases, but they varied in size and content, which is not in accord with his description.

In the group of 11 patients with spontaneous hematomas not associated with any coincident disease, there were 9 males and 2 females whose ages varied from 2½ to 75 years. Ten of the patients were more than 48 years of age. The one child, a boy, had been born of an eclamptic mother who had died at the time of his birth. Surgical intervention had not been attempted. His development apparently had been normal. At the age of 2 years however he had fallen from his bed and 3 weeks prior to his admission to the clinic, impairment of vision had developed and at the time of admission he was totally blind. Examination had revealed a hydrocephalus, generally diminished reflexes, ataxic gait, nystagmus to both sides and choked disks of 2 to 3 diopters. Necropsy revealed external hydrocephalus grade 2 (on the basis of 1 to 4) and internal hydrocephalus grade 1. There were large bilateral subdural hematomas. It is interesting to theorize as to the genesis of this condition and the part played by eclampsia, likewise there is the factor of the expanding lesion in the presence of an already increased intracranial pressure.

The duration of the lesion in the remainder of the cases of this group was impossible to ascertain clinically. The hematomas were unilateral in 5 cases, bilateral in 6, and they varied in size from massive bilateral tumors each containing 300 cubic centimeters of material and compressing the brain, to small areas of hemorrhage scattered throughout the dura. The contents varied from blood and blood stained fluid to deep chocolate brown material and clots.

Microscopically these hematomas did not differ essentially from those of the traumatic type. No differentiation could be made on the basis of the

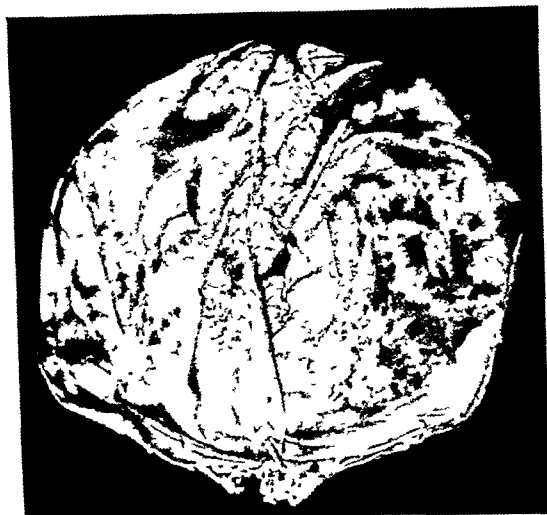


Fig 1 Bilateral multiple small hemorrhages

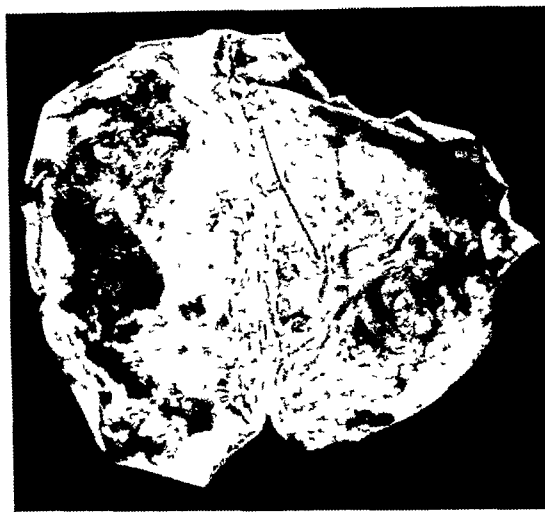


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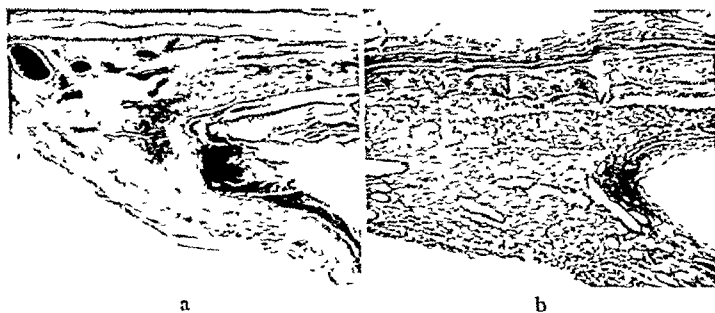


Fig 3 a, left Endothelial lined spaces in the hematoma, spaces filled with blood, and b, thick meningeal layer, with empty endothelial lined spaces.



Fig 4 Unilateral hematoma with injury to opposite cerebral peduncle. This resulted in a paradoxical homolaterality of pyramidal tract signs.

HISTOPATHOLOGY

The hematomas described in this series of cases were all of a similar character. The outer or periosteal layer of the dura mater showed no change except in the case of older lesions where phagocytes laden with pigment were usually seen. This pigment was largely in the form of hemosiderin and was seen in sections stained for iron. There frequently was some hyalinization of the connective tissue. The middle layer, in which the hematoma formed, was filled with blood in various stages of degeneration, the more advanced degeneration appearing in older lesions. The inner lining of the hematoma was composed of new connective tissue cells. This organization was best seen at the angle where the separation in the dura had occurred. At this place bands of newly formed fibroblasts projected into the degenerative blood clot. In this new tissue and external to it were seen the dilated endothelial lined spaces which occasionally contained erythrocytes. These spaces were irregular and varied greatly in size. The inner or meningeal layer was thickened, edematous and contained many fibroblasts in the process of organizing the clot.

In a few of the cases sections were taken from positions remote to the site of the hemorrhage. These were examined for evidence of chronic inflammation particularly and so far as could be determined they appeared to be normal. This does not, however, eliminate the possibility of a localized area of inflammation predisposing to hematoma formation. In examining the sections taken through the hematomas occasional small



Fig 5 Bilateral hematoma with bilateral compression of brain.

collections of lymphocytes were noted but it must be remembered that this reaction might as readily be due to destruction of blood as to any chronic inflammation.

In the 1 case in which there was clinical and serological evidence of syphilis and in which the lesions resembled miliary gummas the lesions were undoubtedly due to syphilis and in this case may conceivably have played a part in the production of the hematoma. In all 3 cases in which there was an associated blood dyscrasia collections of lymphocytes were noted. Here again as in the presence of syphilis, one must definitely consider the possibility of a local accumulation of lymphocytes playing a causative rôle in the formation of the hematoma.

Contradictory reports have been published as to the fate of blood subdurally injected. Putnam and Putnam said in part that. Apparently a true progressive chronic hematoma of the dura has never been produced experimentally. The lesions seen after the subdural injection of blood and in patients after operation resemble the progressive lesion in appearance but not in behavior. From a purely theoretical standpoint it would seem plausible that blood set free in this potential space would flow to the dependent portions and fail to become encapsulated simply because of the diffuse distribution of the blood. In this regard it might be said that in our experience at least blood subdurally located at the site

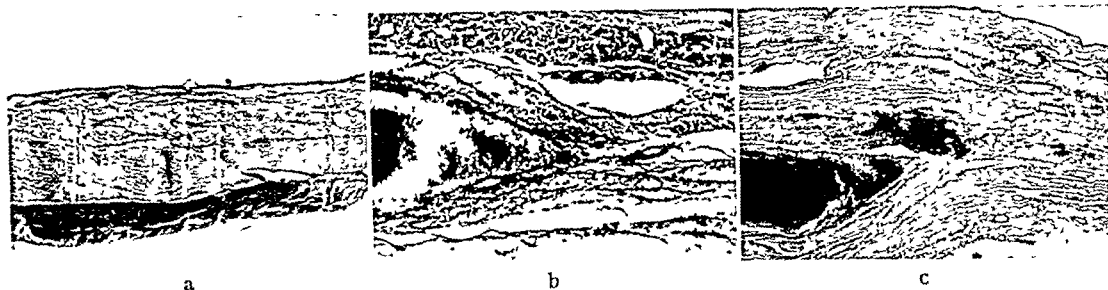


Fig 6 a, Normal dura, showing medial vascular and outer and inner fibrous layers, b, fresh hematoma, showing

invading and splitting character of the blood clot, and c, old hematoma, showing organization that has taken place

of trephine wounds organizes from the dural side only and shows no evidence of membranous formation (Fig 6)

No evidence could be deduced from this series of cases which would put all cases of so called subdural hematoma into one etiological classification, that is, traumatic or spontaneous. It should be kept in mind that only relatively slight trauma may produce these hematomas and also that in the group of cases in which spontaneous hematomas appeared the history was often unreliable and mishaps of a slight nature could have readily been overlooked. These considerations, together with the known etiological rôle played by trauma in many of our cases tend to make one feel that they may well have all been of traumatic nature.

DIAGNOSIS

So called subdural hematoma still goes unrecognized in a large percentage of cases. Neurologists and neurosurgeons who are constantly seeing cases of increased intracranial pressure and of cerebral compression usually consider the lesion in the differential diagnosis of many intracranial lesions, particularly if there has been a history of cranial trauma. The general surgeon and the general practitioner, however, who see most of these patients in the early stages, are not fully aware of the condition itself, its insidious development, and the methods whereby diagnosis can be made during the optimal time for successful treatment. The clinical picture presented by patients with dural hematomas is quite confusing and any evidence of a pathological nature which might aid in identification of the condition is to be sought for. The latent period is perhaps the most characteristic of all the clinical features of so called subdural hematoma and perhaps the most difficult to explain. The period preceding the onset of neurological signs may apparently be uneventful, or in the cases in which there is a definite history of trauma, symptoms may be initiated by

a period of unconsciousness immediately following the trauma. The patient appears to recover from this in the space of a few minutes and then, after a varying period of time, often several months, he begins to show indefinite neurological signs of the lesion.

It is possible that the cessation of bleeding is brought about by an increase in intracranial pressure due partly to the hemorrhage. Into this clot, newly formed vessels grow which are fragile and can be easily damaged and lead to further bleeding. This theory of successive bleeding seems most logical although Munro and Merritt have also postulated a very ingenious theory to explain the growth of these expanding lesions. They maintain that every subdural hematoma starts as a mixture of blood and cerebrospinal fluid. With dissolution of the blood, there is an increased protein content and, with diffusion of fluid across the pia arachnoid, there results an increasing volume of solution. This dissolution of blood with a consequent increase in protein content covers a period of about 16 days, following which rapid dilution takes place for the two succeeding weeks. Slower dilution then occurs for at least 2 months. This explanation may be the logical one if we grant the admixture of blood and cerebrospinal fluid. This could occur, however, only in case of tearing of arachnoid, and thus such an admixture obviously could not occur in hemorrhages which are truly intradural. Furthermore, the cerebrospinal fluid would, in cases of intradural hemorrhage, of necessity suffuse the arachnoid as well as the inner layer of the dura. It might be just as logical to suppose that, if dilution actually did take place, the fluid added is derived directly from the blood stream by means of the endothelium lined tissue spaces mentioned previously.

Perhaps the most confusing of the clinical signs presented lies in the bizarre nature of the neurological signs presented. It must be remembered that a large unilateral (6) tumor or a hematoma may



Fig 4 Unilateral hematoma with injury to opposite cerebral peduncle. This resulted in a paradoxical homolaterality of pyramidal tract signs

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There has been and probably always will be some discussion as to the best method of removal of such an intracranial hematoma. It seems to us that the most satisfactory way to cope with the lesion is through an osteoplastic flap which is of sufficient size to give adequate exposure. If the hematoma is evacuated through a bur hole, other loculations of blood may be left behind (11) because they were not visualized, or a bleeding point may be missed. If after careful consideration of the individual case there is still some doubt as to the proper procedure, it would appear advisable for the surgeon to trephine both sides due to the paradoxical signs which may be present and also because of the high incidence of bilaterality (50 per cent in this group of cases).

SUMMARY AND CONCLUSIONS

A theory that so called subdural hematomas occur intradurally in the middle vascular layer of the dura is reviewed. A study of 30 cases substantiates this theory, and while we admit the possibility of the existence of a true subdural collection of blood, we stress the point that most such lesions are intradural in character. The cases in our series were divided into two groups, spontaneous and traumatic, according to whether or not there was a definite association between trauma and the presumed onset of clinical symptoms. The pathological picture in these two groups of cases was studied and in our experience almost identically similar lesions were encountered in both.

From a review of the literature on subdural hematomas it becomes apparent that at least part of the confusion in the clinical picture is due to an insufficient understanding of the pathological process that is present. We have considered the generalized symptoms of pressure due to the mass of blood in a closed cavity and have stressed especially the confusion which may arise in the presence of paradoxical homolaterality of pyramidal tract signs due to pressure injury of the cerebral peduncle on the side opposed to the lesion.

The clinical picture is briefly reviewed and the value is given of encephalography and ventriculography.

Trephining on one as well as on both sides is strongly recommended as a diagnostic and therapeutic maneuver. Because of the high incidence of bilaterality of these hematomas (50 per cent in this group) we strongly advise bilateral exploration.

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cause sufficient pressure to compress the opposite cerebral peduncle onto the cerebellar tentorium. This, of course, results in damage to the pyramidal tract and results, clinically, in paradoxical homolaterality of the pyramidal tract signs, such as the Babinski reflex spasticity, clonus, and increased reflexes. The sensory relations remain undisturbed as a rule because of their deep seated location in the lemnisci.

The other group of clinical signs which might occur could be general and be due to the increase in intracranial pressure.

It is thus seen that this apparent confusion of clinical signs can best be interpreted in the knowledge of the pathological change which may be present.

REVIEW OF THE CLINICAL MATERIAL

Inasmuch as this report is based upon a study of necropsy material it is extremely important to review the pertinent clinical findings. Twenty of the patients in the series had been registered as patients at The Mayo Clinic and had undergone complete examinations during life. Nine of the patients had been inmates of the Rochester State Hospital, and the thirtieth was a coroner's case.

Since we were interested originally in the cellular pathology of this lesion many cases are included in this study that ordinarily would not be considered those of subdural hematomas. Certainly, in some of the cases the lesion found at postmortem examination could not have been productive of symptoms that would have led to an antemortem diagnosis of subdural hematoma.

Since the records in the State Hospital cases and the coroner's case are not complete in all details, little time will be devoted to analyzing this group. Recalling the recent article by Holt and Pearson we should be on the lookout for subdural hematomas masking under the guise of insanity.¹ In 2 of the 9 State Hospital cases it appeared that a subdural hematoma was not only the cause of the death but possibly also the cause of the illness which resulted in the patient's commitment.

Of the 20 cases in which the patients had been examined at the clinic the postmortem findings in 16 justified the conclusion that the symptoms were explainable on the basis of the subdural collection of blood. Likewise the death in each of these 16 cases could be charged to the intracranial hematoma. In the 4 remaining cases the collec-

tion of blood was not of sufficient size to have played much of a rôle in the patient's illness.

In 14 of the 16 cases in which the hematomas were of appreciable size a clinical diagnosis of an organic intracranial lesion was made. Six of these patients underwent craniotomy to obtain relief from intracranial pressure. The 8 others were not operated on because their poor condition contra-indicated surgical intervention.

The presence of a collection of blood beneath or within the dura mater can be suspected from the various symptoms listed above but the diagnosis rests on a demonstration of the characteristic lesion after an opening has been made in the skull. Recently (5) evidence has been presented that the diagnosis may be confirmed prior to craniotomy by the employment of pneumo-encephalography. On the other hand roentgenograms made after the intraspinal injection of a gas may be very misleading, and at times it may be impossible to differentiate the cerebral compression due to a large neoplasm from that due to a hematoma. Certainly, a hematoma cannot be differentiated prior to operation from a somewhat similar condition namely, chronic subdural hydroma (9). This differentiation, however, is of little consequence since the treatment is essentially the same.

In the past we have been more or less inclined to consider subdural collections of blood as occurring principally in young adults and middle aged individuals who are most likely to have suffered blows on the head. In the present series of cases however 5 patients were beyond 70 years of age and 1 of us (Love 10) has reported the case of a newborn identical twin who was operated on successfully for a classic subdural hematoma.

If the history in any given case together with the symptoms and signs if any are present, suggests cerebral compression from a hematoma and the lesion cannot be localized by neurological methods, encephalography should be carried out if there is no choking of the optic disks and ventriculography if any edema of the optic nerve is present. If ventriculography is undertaken in the presence of a subdural collection of blood the lesion will usually be encountered when the dura mater is incised through the bur hole preliminary to needling the lateral ventricle.

TREATMENT

The only treatment is surgical removal of the hematoma. The encasing membrane should be removed as completely as possible in order to permit complete restoration of the brain to its normal shape and position.

¹Recently one of us (Lo) saw a patient who had been previously examined by complete roentgenology and who had been installed in the State Hospital after the removal of a subdural hematoma. The patient was comatose.

There has been objection to the use of tongs because the patient may disarrange them with consequent tearing of the scalp. To overcome this objection it is evident that, if tongs are to be used, they must be so designed and constructed that the possibility of their being disarranged and tearing the scalp is eliminated. With this end in view, the tongs to be described were designed by the writer and were subsequently used by Cone and Turner in some of their later cases as well as by other surgeons.

The tongs are made of rustless steel and resemble in some respects the conventional tongs used in the treatment of fractures of long bones. They consist of two arms (Fig 1) articulated so that they may be opened and closed by means of a turnbuckle—to adapt them to skulls of varying transverse diameters. At the distal extremity of each arm there is a tapered sleeve, integral with, and at right angles to, each arm, through which drills are passed. The drills have a trocar point and a shoulder at their outer extremity, which prevent the drill point from emerging from the sleeve more than a pre-determined distance. The drills are of different lengths, one permitting a penetration of

the bone to a depth of 4 millimeters, and the other length allowing a penetration of not more than 7 millimeters, thus rendering the tongs adaptable to both children or adults.

In the application of the tongs, it is essential that the location selected be at the point of greatest convexity of the parietal bone, which will be approximately 1 inch above the pinna of the ear. At this point the drills will then be at right angles both to the surface of the bone and to the line of traction, thus lessening the danger of evulsion of bone from the external table when traction is applied.

In applying the tongs just described, a stab wound through scalp to bone is made on each side of the head at the points selected, the drills are removed from the sleeves, and the sleeves are inserted into the stab wound and the tongs closed by means of the turnbuckle until the sleeves are firmly in contact with the bone. The drills are inserted in the sleeves and drilled in until the shoulder on the outer end of the drill is in contact with the sleeve. The drills are left in place and are secured from slipping out of place by means of set screws.

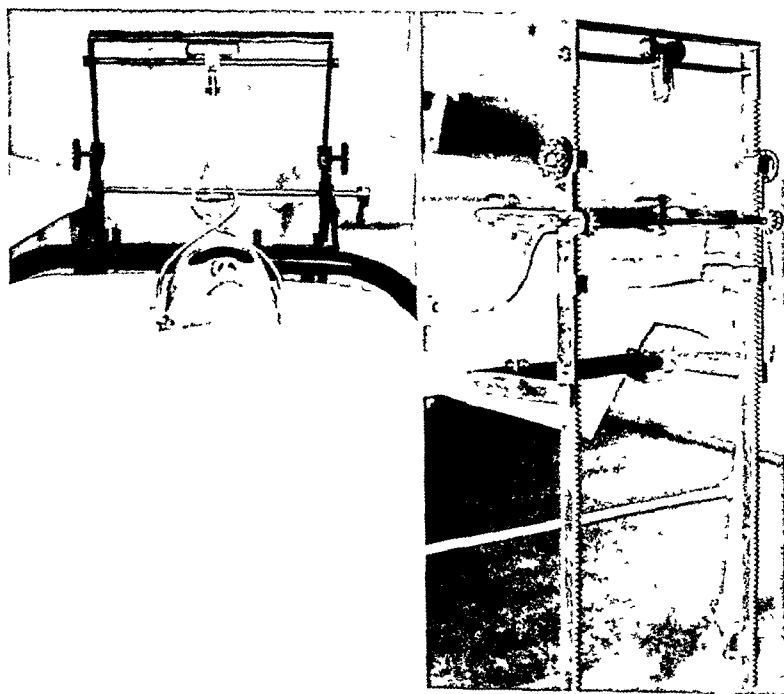


Fig 2, left. End view of Barton frame showing transverse rod and trolley.
Fig 3. Side view of frame showing mechanism for raising in vertical plane.

THE REDUCTION OF FRACTURE DISLOCATIONS OF THE CERVICAL VERTEBRÆ BY SKELETAL TRACTION

LYMAN G. BARTON, Sr, M.D., F.A.C.S., Plattsburg, New York

THE reduction of fracture dislocations of the cervical vertebræ by skeletal traction has been demonstrated to be a method of practical value. There is however, a diversity of opinion as to the manner in which this method should be applied. In order to form an adequate idea of the advantages or disadvantages of the various methods to be described, it will be necessary to go into detail in describing the apparatus used, the methods of application and certain mechanical principles involved.

Crutchfield, for example, advocates the use of tongs and has designed a special instrument for this purpose. He criticizes the conventional type of tongs because they do not permit the patient to lie on his side with comfort. In order to overcome this objection, he has devised a tong which is smaller and which is applied relatively high on the vertex. With the tongs applied in this situation the prongs penetrate the bone at an acute

angle with reference both to the external table and to the line of traction. Due to the high position of the tongs and to the angle at which the prongs enter the bone, it should be necessary to limit the amount of traction force to a marked extent—in order to avoid evulsion of a fragment of bone from the external table and consequent disarrangement of the tong. It naturally follows by reason of the limited amount of traction force that can be applied, that the time required for a complete reduction of the dislocation will be materially extended, possibly to several days.

Cone and Turner did not approve of tongs but in a fairly large series of cases used wires attached to the skull through bur holes, and, after the wires were attached, it has been their custom to apply a sufficient amount of traction to effect reduction in a period of time that has been reduced to minutes instead of hours or days. In order to attach the wires to the skull it is necessary to expose the bone through longitudinal incisions on each side of the vertex a few centimeters from the midline, to burr two holes through to the dura on each side, through which heavy wires are passed and twisted snugly around the bridge of bone connecting each pair of bur holes and, finally to suture the incisions.

Although this is done under local anesthesia it consumes time and is a more formidable procedure than the application of tongs.

As the wires emerge from the skull at practically a right angle to the surface, traction in this line may detach the bridge of bone to which the wires are attached—if too great a force is applied. The possible risk of this mishap occurring is always present.

An important accessory to their method is a frame attached to the head of the bed on which the patient lies. This frame has a transverse bar—carrying a trolley through the lower pulley of which is passed a cord leading from the wires to weights for traction. The transverse bar with its trolley may be raised or lowered by a threaded shaft—to alter the line of traction and facilitate reduction. The lateral movement of the trolley on the transverse bar enables the patient to move from side to side and to be turned on the side for nursing care.

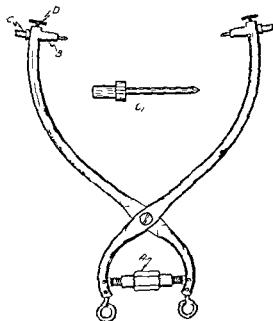


Fig. 1. Barton tong. A turnbuckle B sleeve C drill C₁ drill enlarged D set screw

THE RADICAL BREAST OPERATION

HERBERT C CHASE, M D , F A C S , New York, New York

THE evolution of the modern radical breast operation from the crude, futile mutilations of 2500 years ago to the present day systematic, clean and thorough dissection, represents one of the greatest triumphs and most romantic chapters of modern surgery

TECHNIQUE

The incision for the radical breast operation has undergone revision, modification, and gradual extension with the elucidation of the pathology. From the early incisions of Kocher, Murphy, Warren, Rodman, Halsted, Willy Meyer and Jackson has been evolved the longer, wider, and more extensive modern incision (Figs 1 and 1a)

Sampson Hanley has added two distinct principles to the technique of the radical operation (1) wider area of fascial removal, (2) removal of the epigastric nodes. The radical breast incision then must meet the following requirements. First, free and wide access to the axilla, second, wide skin and fascial removal, third, access to the epigastric triangle. Upon this basis the incision is planned as follows. Beginning over the humeral groove, the incision passes downward across the chest wall, crossing the costal margin at a point just mesial to the junction of the ninth costal cartilage, and ending well below the costal margin at the center of the epigastric triangle. The outer limb of this incision, to be added at the end of the

operation, can be varied according to the location of the tumor mass, as also can the inner limb. There should always be a 3 inch radial diameter from the border of the lesion to the skin edge. One should always try to plan, if possible, skin flaps which can be closed and grafting avoided, because grafts preclude early postoperative x-ray therapy, and the time element is the important thing in such treatment. A glance at Figure 1 will show that this incision meets the requirements outlined. The first layer then consists of skin and thin skin only.

As the skin flaps are dissected free, the outer flap is first raised, freed, and turned outward, the breast falling laterally, and in this position is handled no further, nor squeezed or pressed upon during the entire course of the operation. The mesial flap is likewise kept thin (skin only) and is dissected upward above the clavicle and mesially to the center of the sternum throughout its entire length (Figs 2 and 2a)

Layer 2 is composed of superficial fascia and pectoralis major. In the groove between the deltoid and pectoralis major lies the cephalic vein which marks the division of these two muscles. Using the cephalic vein as a guide, the upper fibers of the pectoralis major are separated from the deltoid down to the insertion of the pectoralis major in the humeral groove (Figs 2 and 2a). The finger is passed under the tendinous insertion of



Fig 1 The incision From humeral groove to center of epigastric triangle

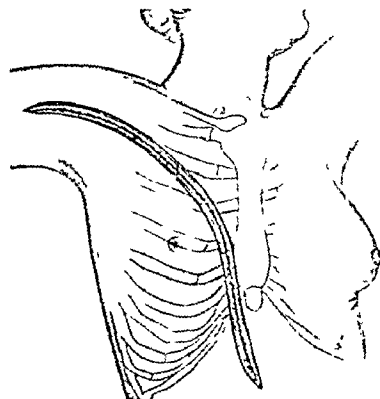


Fig 1a Diagram showing exact location of incision in relation to chest wall

A frame (Figs 2 and 3) designed to be used with the tongs, while embodying all the principles of the frame used by Cone and Turner, is entirely different in construction.

The use of an adjustable frame in conjunction with either wire or tong traction has distinct advantages, as it facilitates the reduction of the dislocation and adds to the comfort of the patient.

The only advantage in the use of tongs is the simplicity and ease of their application. When properly constructed and applied, all the requisite traction force required to effect a rapid reduction of the dislocation can be employed with no more risk of bone evulsion than when wires are used.

SUMMARY

1 Three methods of reduction have been described, two employing tongs, the other wires.

2 In one method where tongs were used by reason of the relatively small amount of traction force applied the time required for reduction was extended as compared with other methods where

the traction force was sufficient to complete reduction in a matter of minutes.

3 The risk of bone evulsion has been mentioned when too great a force is used with tong or wire traction.

4 This risk is less when the application is at a point where the line of traction is tangential to the surface of bone at this point i.e. at the greatest convexity of the parietal bone, and progressively increases at all points above in the direction of the midline of the vertex.

5 The tong described has no advantage over wires other than ease of application and the ability to be applied at the optimum point.

6 Attention has been called to the value of the frame as a means of facilitating reduction and of adding comfort to the patient.

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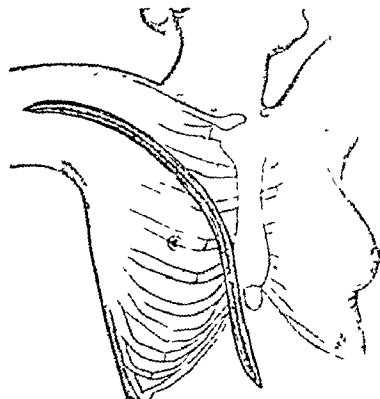


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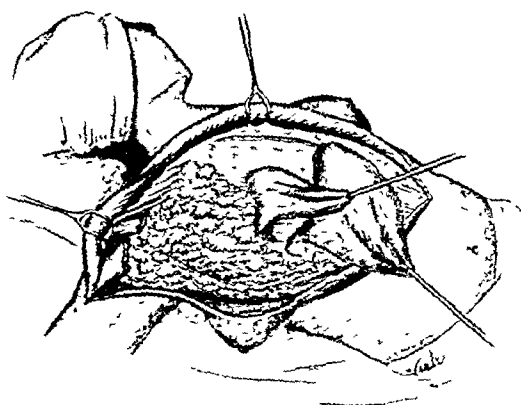


Fig 4 Pectoralis minor stripped from its envelope and freed to base

principal gland groups (subclavicular, pectoral, and axillary) We begin the separation of this single layer at the apex of the axilla and above the vessels, of which it forms the anterior sheath. This layer is cleared of the vessels by sharp dissection and brought down *en bloc*, in a single sheet (Figs 5 and 5a) As this is done, the vessels passing through and lying in this layer (the superior, alar, long and acromial thoracic vessels) are divided between clamps at some distance from the main trunk, lest the thrombus from ligation extend into the main vessel. In this single sharp bloc dissection of this one layer, approximately 90 per cent of the nodes of the breast are removed, the subclavicular 4 to 8, the pectoral 6 to 8, the axillary group 10 to 14, leaving only the subscapular group of 4 to 6 nodes. The great pectoral

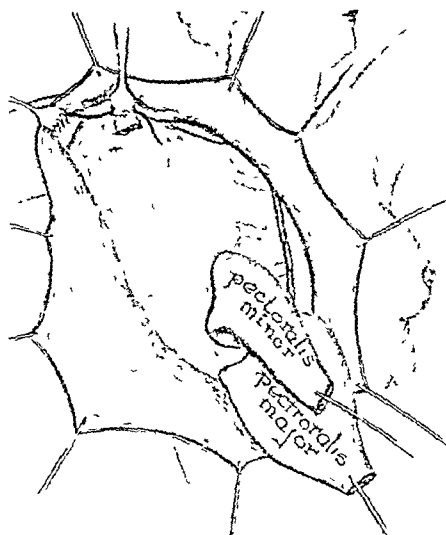


Fig 4a Diagram showing both divisions of deep pectoral fascia

fascia, axillary and pectoral portions, is freed and dissected downward beyond the border of the latissimus dorsi where it becomes continuous with the fascia of the back (see also Figs 5 and 5a).

And then layer 4, the subscapular fascia, which forms the floor of the axilla and contains group 4, the subscapular nodes. Beginning above in the cervico-axillary passageway, where it is continuous with the prevertebral layer of the deep cervical

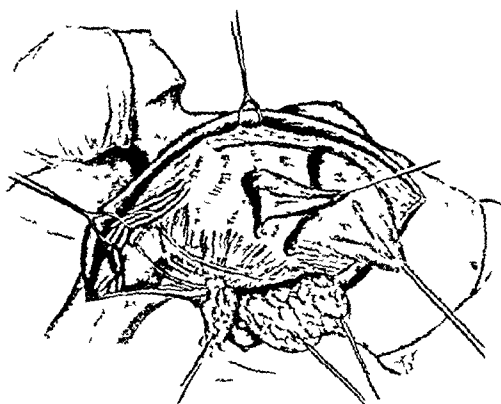


Fig 5 The great pectoral fascia has been dissected away *en masse* thus exposing layer 4, the scapular fascia and nodes

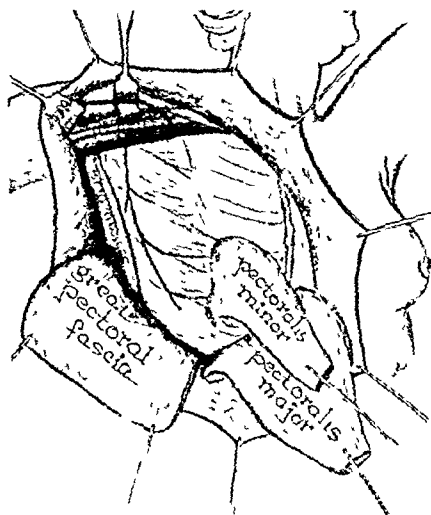


Fig 5a. Diagram showing layer 4—subscapular fascia, brachial nerve root, axillary vessels, nerve of Bell (mesial) and middle subscapular nerve (lateral)

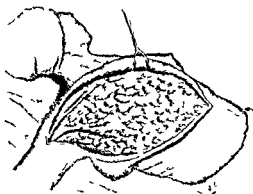


Fig 2 Layer 1 (thin skin only) has been reflected. Layer 2 consists of superficial fascia and pectoralis major

the muscle and it is divided close to the bone grasped with a clamp and dissected downward together with its covering the superficial fascia its sternal insertion being divided close to the sternal border and the muscle freed downward to its basal attachment (Figs 3 and 3a). As it is drawn downward the structures entering its substance the external anterior thoracic artery, nerve and vein are divided between clamps.

This step exposes layer 3 composed of pectoralis minor and the great pectoral fascia axillary and thoracic portions (see also Figs 3 and 3a). The insertion of the pectoralis minor into the coracoid is exposed and an incision is made along its lateral borders 2 to 3 inches in length through the anterior lamella of the clavicular pectoral (costocoracoid) fascia. The index finger is passed under the tendinous insertion and the

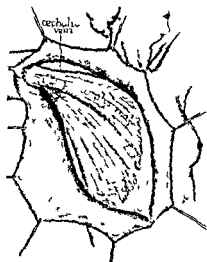


Fig 3a Diagram showing layer 2. Cephalic vein separates deltoid from pectoralis major

muscle divided at the coracoid clamped and retracted downward. As it is drawn out of its envelope and dissected downward the structures entering its substance the internal anterior thoracic artery, nerve and vein are severed and along its axillary border the long thoracic artery and vein are divided between clamps. Now we have exposed before us in one layer the entire great pectoral fascia pectoral and axillary portions (Figs 4 and 4a) containing three of the four

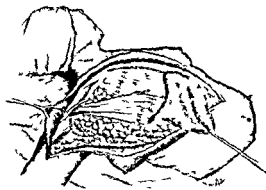


Fig 3 Pectoralis major reflected exposing layer 3 (pectoralis minor plus deep pectoral fascia)

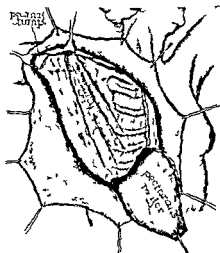


Fig 3a Diagram of layer 3. Showing pectoral and axillary portions of deep pectoral fascia

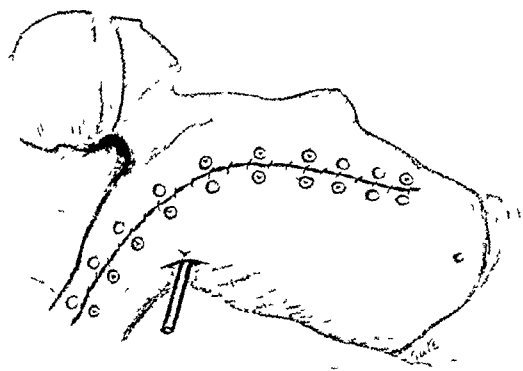


Fig 8 The closure The incision is well forward (No scar in axilla)

not been handled throughout the entire course of the operation, must now be removed from the lateral flap and the outer limb of the primary incision is now added. It is planned and patterned (see Figs 7 and 7a) so that there is at least a 3 inch radial diameter from the border of the lesion to the skin edge. After the breast is cut away, the flaps are approximated. A stab wound drain is placed in the axilla and closure is begun, interrupted sutures of silkworm gut being used (see Figs 8 and 8a), with Davey buttons for broad traction and to prevent cutting in, and a continuous suture of fine silk alternating superficial and deep stitches to evert as well as approximate the skin edges.

There is one part of the technique of the radical breast operation which can not be set down in print or in pictures. For many years, it has been my belief that most of our local recurrences and postoperative metastases are due, not to inadequate and incomplete removal of all structures, so much as to squeezing of the breast and contact implantation by hand and instruments, at the time of the operation and by the operator. It is not enough that one be tumor minded. The surgeon must be cancer cell minded. We have repeatedly made stained slides of cancer cells wiped from the rubber gloves, the knife, the clamps, etc., and have demonstrated cancer cells in centrifuged specimens from the basins of saline and water in

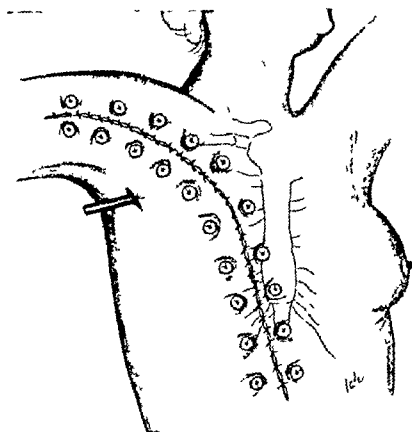


Fig 8a Diagram showing location and extent of the incision

the operating room. In other words, I believe that many of us, making a wide and thorough dissection, open up great areas and then contaminate and implant this field with cancer cells. Yet not one of us would think of cutting through an infected area of the abdominal wall, entering the abdominal cavity and proceeding without changing knife, gloves, instruments, gowns, etc. The analogy is exact.

The technique, as described and planned, avoids handling the breast and is, I believe, systematic, thorough, and wide. Yet, this is not enough. We must use an antiseptic technique. Pads moistened with strong antiseptic solution must cover the margins of the incision throughout the procedure and must be changed often. Gloves must be changed after the primary incision (the only time the breast is handled), the second pair of gloves washed frequently in antiseptic solution during the operation. The instruments, after being used, should not be allowed to come back into the field. All should be discarded and re-boiled. All basins in the operating room in these cases should contain an antiseptic solution and not saline and water, and finally the entire field should be flushed out with the antiseptic solution and large pads moistened with this solution placed in and left to cover the field while the surgeon washes his gloves for the last time and completes the closure.

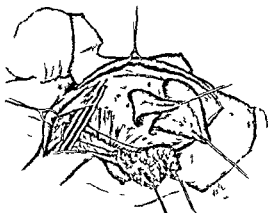


Fig 6 Axillary vessels retracted upward Layer 4—Subscapular fascia—dissected from behind vessels and downward to its base

fascia and forms the posterior sheath of the axillary vessels, it passes downward to cover the subscapularis muscle. Retracting the axillary vessels upward, sharp dissection is begun at the apex of the passageway behind the vessels (Figs 6 and 6a) and is continued downward, taking with the fascia all of group 4 nodes. Two important structures must be identified and preserved. On the inner wall of the thorax lying on and supplying the digitations of the serratus magnus (Figs 6 and 6a) is the long thoracic or external respiratory nerve of Bell. Lying along the mesial border of the scapula easily identified by the veins which accompany it is the middle or long subscapular nerve to the latissimus dorsi; accidental section of which gives the characteristic angel wing deformity. The subscapularis fascia freed

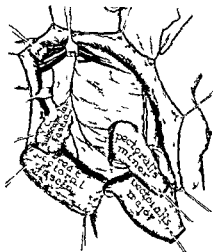


Fig 6a Diagram of layer 4—subscapular fascia—middle subscapular nerve retracted outward Bell's nerve mesial Both to be conserved

from these two structures is brought downward in one piece and dissected out well beyond the latissimus border (Figs 6 and 6a). All the structures which have been dissected free including the pectoralis major covered by the superficial fascia, the pectoralis minor together with the great pectoral fascia, axillary and pectoral portions and the subscapularis fascia are removed at their basal attachment well beyond the latissimus border.

As the pectoralis major is freed and removed its attachment to the fascia is cut away well down into the epigastric triangle and the fascia of this region is removed. The breast which has



Fig 7 The outer or second limb of the incision is added at end of operation

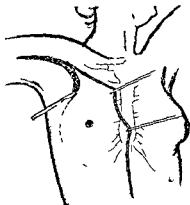


Fig 7a The outer or inner limb can be patterned according to site of lesion

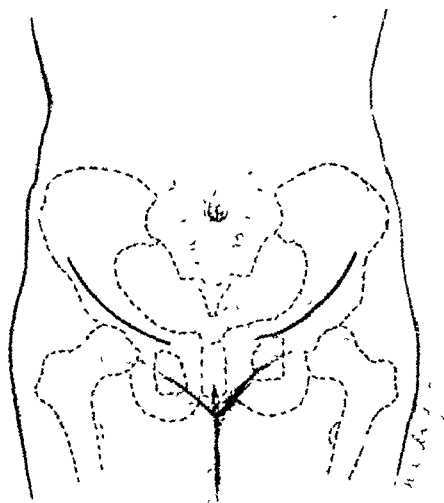


Fig 1 Incisions for bilateral ligation of hypogastric arteries

Statistics referable to hemorrhage as a cause of death in uterine carcinoma are meager in analyses of large series of cases. In a mortality study of 1,117 patients with uterine carcinoma treated at the Mayo Clinic, Fricke states that many patients die from hemorrhage due to erosion of large pelvic vessels, but gives no figures. Faerber, in a study of 150 autopsy records of uterine cancer reports 3 deaths from hemorrhage, while Pearson reviewing 57 consecutive autopsied cases of carcinoma of the cervix found hemorrhage to be the cause of death in 5 or 9 per cent of the cases. Of 11 deaths occurring from 3 to 53 days after treatment in a series of 373 cases, Pitts and Waterman ascribe 2 of the 11 (18 per cent) to hemorrhage. The pitiful fear experienced by these unfortunate women who have had the maximum of radiation therapy and who have repeated hemorrhages warrants a palliative procedure for the control of this symptom.

ANATOMY

The hypogastric artery supplies the walls and viscera of the pelvis, the buttock, the generative organs, and the medial aspect of the thigh. It arises at the bifurcation of the common iliac artery opposite the lumbosacral junction and passing downward to the upper margin of the greater sciatic foramen, divides into two large branches, an anterior and a posterior. The branches of the anterior trunk are superior vesical, middle vesical, inferior vesical, middle hemorrhoidal, obturator, internal pudendal, inferior gluteal, uterine, and vaginal arteries. The posterior

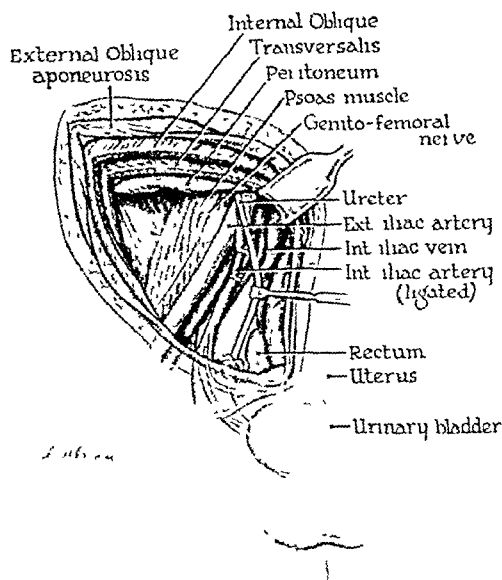


Fig 2 Surgical relationship of extraperitoneal structures, as found at operation

trunk branches are ilio-lumbar, lateral sacral, and superior gluteal arteries. The collateral circulation after ligation of the hypogastric artery is adequate (see Gray's *Anatomy*) so that no injury is done to other pelvic structures while circulation to the uterus is decreased to stop hemorrhage from the carcinomatous area.

SURGICAL TECHNIQUE—EXTRAPERITONEAL ROUTE

The anesthesia is ethylene or nitrous oxide. The operative field is prepared as for an inguinal hernia. An incision is made about 1 to 2 centimeters above Poupart's ligament, beginning near the external inguinal ring and continuing upward and outward parallel with the ligament to the anterior superior iliac spine (Fig 1). It may be prolonged upward as far as necessary in the cleavage line of the external oblique. As the incision is deepened the structures encountered are skin and superficial fascia, external oblique aponeurosis, internal oblique aponeurosis (care being taken to avoid the iliohypogastric and ilio-inguinal nerves between the internal oblique and transversalis), transversalis muscle, and fascia. The peritoneum is gently pushed mesially and upward until the external iliac artery is exposed. This is followed upward to the common iliac artery at its bifurcation. The mesial member at this bifurcation is identified as the hypogastric artery (designa-

HEMORRHAGE FROM CARCINOMA OF THE CERVIX

Control by Extraperitoneal Ligation of the Hypogastric Arteries

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THE bilateral ligation of the hypogastric arteries (internal iliac) is a simple procedure and deserves a place as a palliative operation for the treatment of uncontrollable hemorrhage from advanced carcinoma of the uterine cervix. When it is performed by the extraperitoneal route it carries no mortality and does not jeopardize the nutrition of the other pelvic structures, such as the bladder or rectum. The European literature contains numerous reports of cases in which this operation was performed, but in our investigation we could find no series of such cases reported from any American clinic. Because of this and because of the simplicity of the operation and its effectiveness in controlling exsanguinating uterine hemorrhage, this report is presented.

As early as 1629 Johann Mays had advised the attack of tumors by ligation of their blood supply. Harvey (1651) observed a regression in the size of tumors following ligation of their blood supply. Baumgartner, in 1888, was the first to employ bilateral hypogastric artery ligation for inoperable carcinoma of the uterus. His patient lived two years after the operation. Pryor in 1897 and Kronig in 1902 performed transperitoneal hypogastric artery ligation for inoperable cancer of the cervix. Asarnides (1924) collected 42 cases (including 1 of his own) of severe hemorrhage from inoperable carcinoma of the uterus treated by transperitoneal hypogastric ligation. The results were perfect in 17 cases, good in 15, mediocre in 5. In his own case there was a cessation of hemorrhage and pain, regression of the tumor and a 14 month survival. In 30 per cent of the cases the fetid discharge decreased markedly. Orthner in 1923 described a technique for the extraperitoneal ligation of the hypogastric arteries which he considered ideal for hemorrhage and fetid discharges in advanced cancer of the cervix. Hartung's experience in 23 cases published in 1931 further demonstrated the absence of mortality and of impairment of function of any of the pelvic organs. He recommended the procedure (1) as a preliminary step

to the Wertheim operation to allow for a more radical removal of tissue with less hemorrhage, (2) following exploratory laparotomy when inoperable carcinoma of the cervix was found and (3) as an extraperitoneal operation for severe hemorrhage. In 1933 Haupt reported a large series of 67 cases. In all but a few of these cases the bleeding was controlled. In 7 cases in which bleeding continued he ligated the ovarian arteries through the same extraperitoneal approach and achieved control of the bleeding. In 3 additional cases he ligated the round ligaments also again extraperitoneally. Tubas in 1933 reported 14 cases of inoperable cancer of the cervix in which this operation was performed and followed by x-ray therapy. He had the impression that in some of the cases the tumor diminished in size. Frommelt, in 1934, employed the intraperitoneal ligation method to control hemorrhage in 3 cases of advanced carcinoma of the cervix. The author does not record any follow up made in these cases.

In the American literature reports are few and we have found no mention of hypogastric artery ligation for uterine hemorrhage by the extraperitoneal route. Massart in 1920 recommended the ligation of the hypogastric arteries during the abdominal operation for cancer of the cervix or corpus uteri. In a report published in 1914 Taylor and Peightal mention 1 case in which cautery of the primary lesion and ligation of both hypogastric arteries was done with no evidence of the growth 4 years later. They did not indicate whether the ligation was transperitoneal or extraperitoneal. Pitts and Waterman mention 1 case in which the uterine vessels were ligated because of hemorrhage.

Unilateral ligation of the hypogastric artery has been done for gluteal aneurism. According to Haggard the first ligation of this vessel for this condition by the extraperitoneal route was performed by Stephens of Vera Cruz in 1812. Haggard reported a case of enormous gluteal aneurism successfully treated by such a procedure and quoted Konigsberg who had collected 45 cases up to 1907.

From the Department of Gynecology of the Michael Reese Hospital, Chicago, Illinois.

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BRACHIORADIALIS MUSCLE TRANSPOSITION FOR TRICEPS WEAKNESS

F. R. OBER, M.D., F.A.C.S., and J. S. BARR, M.D., Boston, Massachusetts

WEAKESS or paralysis of the triceps muscle often occurs as the result of anterior poliomyelitis. Such weakness has been considered to be of little practical importance as gravity can be made passively to extend the elbow in most of the positions which the arm assumes. However, certain functions of the arm can be performed only if there is fair or better power in the triceps. For instance, a good triceps is necessary to lock the elbow in extension when crutches are used. Again if the hand is to be placed on top of the head when the patient is erect, sufficient power in the triceps must be present to extend the elbow against gravity. Thrusting and pushing motions with the forearm and hand likewise require triceps power. This operation has been devised to permit the brachioradialis to substitute for a weakened or paralyzed triceps.

INDICATIONS

The brachioradialis muscle should be of at least fair power. The best results are obtained if it is good or normal. If there is insufficient power in the brachioradialis, the extensor carpi radialis longus may be used to strengthen the transplanted brachioradialis muscle.

The operation consists in mobilizing the brachioradialis muscle and transposing it from the lateral to the posterolateral aspect of the forearm and posterior to the lateral condyle of the humerus.

TECHNIQUE

The arm is placed on an arm board, the patient lying supine. No tourniquet is necessary. The skin incision begins on the posterolateral aspect of the humerus 3 or 4 inches above the lateral epicondyle and extends downward just posterior to the epicondyle ending about 4 inches below the radial head on the lateral aspect of the forearm.

The skin and subcutaneous tissues are mobilized by subfascial dissection until the triceps tendon and olecranon are exposed. The anterior margin of the brachioradialis muscle is then carefully defined and the dissection carried beneath it from the lateral epicondyle downward and upward until its nerve and blood supply from the radial nerve and artery are well defined.

The origin of the muscle from the superior two-thirds of the lateral epicondylar ridge of the humerus is defined but not divided. It is difficult to identify a cleavage plane between the brachioradialis and the underlying extensor carpi radialis longus and in some cases the origin of the latter muscle from the lateral epicondyle and lower one-third of the epicondylar ridge may be divided and moved posteriorly along with the brachioradialis muscle.

The freed anterior margin of the brachioradialis muscle is then rolled laterally and posteriorly and is sutured to the fascia and periosteum along the subcutaneous edge of the ulna and olecranon and to the triceps tendon. The subcutaneous tissues and skin are then closed in the usual fashion, fine interrupted silk being used throughout the whole operation. The arm is immobilized in full extension and supination with a light plaster splint and an elastic bandage. Exercises may be started about 10 days after operation and should be continued as long as the ability to extend the arm increases.

There are a few points in the operative technique which should be noted. Care should be taken not to injure the dorsal antibrachial cutaneous nerve as the skin incision is made. The dissection beneath the anterior border of the brachioradialis muscle must be done carefully so as to avoid any possible injury to the recurrent radial artery and to the muscular branches of the radial nerve.

TABLE I—SUMMARY OF CASES

History	Lesion	Radiation treatment completed	Onset of hemorrhage and treatment	Comments
I G Age 51 yrs Vaginal bleeding and profuse discharge of 5 m duration 2 yrs post menopause	Hard ulcerated cervix with left parametrial spread Transistomal cell carcinoma	7-12-30	7-10-36 with 4 recurrences to 8-10-36 Vaginal pack transistomal cautery of cervix Hypogastric ligation 9-13-36 followed by transfusion	No further bleeding No bowel or bladder symptoms Died 3 m after operation
E B Age 40 yrs Severe vaginal bleeding of 8 mos duration. Marked weight loss	Large ulcerated crater extending to vaginal vault on left parametrial involvement Transistomal cell carcinoma	10-10-36 Rad. on stopped due to excessive bleeding	9-20-36 had cervical cancer 10-20-36 vaginal pack did not stop bleeding Hypogastric ligation 10-22-36 followed by transfusion	Slight bleeding after operation Then no bleeding Death of uremia 4 mos later
E S Age 49 yrs Vaginal bleeding 5 m duration 4 yrs post menopause	Hard crater replacing end of cervix with vaginal and parametrial spread Squamous cell carcinoma	1-19-37	7-24-37 had to be packed vaginally but bleeding not controlled Hypogastric ligation 8-1-37 followed by transfusion	No further bleeding Died 2 mos later
M C Age 40 yrs Vaginal bleeding of 4 mos duration	Ulcerated cervix with parametrial involvement Squamous cell carcinoma	2-7-37	5-7-37 bleeding for 1 week despite bed rest and a postoperative transfusion Hypogastric ligation 5-14-37	No further bleeding Died 3 mos later uremic coma
V S Age 43 yrs Vaginal bleeding of 2 mo duration	Hard granular lesion of postcervical lip Transistomal cell carcinoma	5-8-37	10-1-37 severe vaginal hemorrhage Hypogastric ligation 10-2-37	Patient is now well up and about

ted as the internal iliac in the old terminology) (Fig. 2). It is gently freed from the surrounding areolar tissue. An aneurism needle is passed around it near its origin and a double No. 2 chromic catgut ligature is placed snugly. About 2 centimeters distally to this ligature a second similar one is passed and tied. The structures are allowed to fall back into place, the fascial aponeuroses are united with a few interrupted plain catgut (No. 2) sutures, and the skin is closed with interrupted silk sutures. A similar operation is carried out on the opposite side. The diagram illustrates the surgical relationship of the extraperitoneal structures as observed at the operation.

There were 5 patients in whom bilateral extraperitoneal ligation of the hypogastric arteries was performed for severe hemorrhage following maximum radiation therapy for carcinoma of the cervix. The details of these case reports are given in Table I. A few minor complications were experienced during the operative procedure in several instances. In 1 case the internal iliac vein was punctured and had to be ligated. In 2 cases metastatic glands were encountered along the large vessels, but these could be easily displaced to permit exposure of the hypogastric artery.

SUMMARY

1. The literature on extraperitoneal ligation of both hypogastric arteries for hemorrhage from carcinoma of the cervix is reviewed.

2. No harmful changes occur in the bladder or rectum following extraperitoneal hypogastric artery ligation, because of the collateral circulation.

3. This simple operation is followed by no primary mortality and is of value as a palliative measure, or as the only procedure for uncontrollable hemorrhage from cervical carcinoma.

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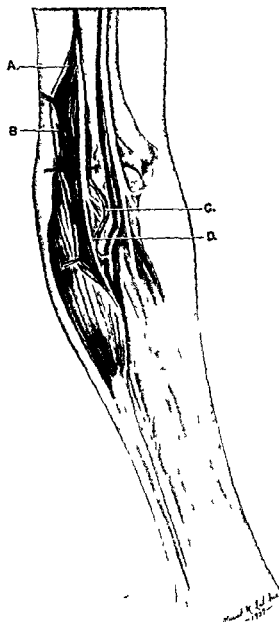


Fig 1 Diagrammatic sketch shows brachioradialis muscle from front. Its nerve supply *A* from radial nerve enters the muscle high up. *B* Anterior edge of muscle lifted up to disclose beneath it radial recurrent artery *C* and radial nerve dividing into its deep and superficial branches *D*

It should be unnecessary to detach the brachioradialis muscle from its origin as transposition of the muscle belly to the posterior aspect of the

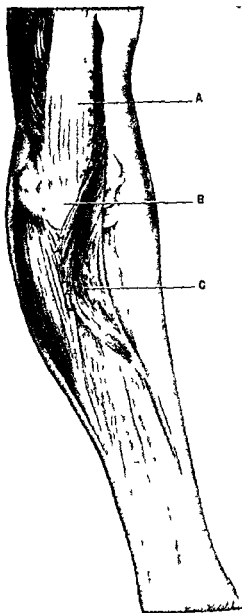


Fig 2 Sketch showing the position of the brachioradialis muscle after transposition. The extensor carpi radialis longus and other muscles deep to the brachioradialis are not shown. *A* Triceps tendon *B* olecranon *C* transposed brachioradialis muscle

elbow joint suffices to change the function of the muscle from that of an elbow flexor to an extensor

Duchenne states that the brachioradialis muscle flexes the elbow and also tends to bring the forearm into the midposition from either full pronation or full supination. Beevor and Wright state that its only function is flexion of the elbow. However, if the elbow is in full extension and the fingers forcibly flexed as in the act of supporting the body weight by the hands on crutches the brachioradialis muscle will be found to be in contraction. Its function is probably that of stabilizing the lateral aspect of the elbow joint and assisting in locking the elbow in extension when the arm is in this position. Muscle re-education after posterior transposition of the brachioradialis muscle has proved to be quite easy in all the cases operated upon.

RESULTS

The first operation was done January 19, 1934, and 4 more patients have been operated upon since that time. One of them had bilateral operations. The extensor power in the elbow has improved so that it can be held extended against gravity in each of the 6 arms operated upon. The patients have been well satisfied with the improvement obtained even though the power is not that of a normal triceps.

CASE REPORT

V P, a white girl age 20 years, had a severe attack of infantile paralysis in December, 1930. All four extremities as well as the trunk were involved. In spite of prolonged bed rest with appropriate splinting and physiotherapy over nearly a 2 year period, a severe bilateral hip flexion deformity and scoliosis developed. A right erector spinae transplant (3) and a left Yount fasciotomy were done October 22, 1932, following which the patient was able to walk with great difficulty with two long braces, crutches, and a corset. The flexion deformity of the left hip recurred and was corrected by a Soutter fasciotomy November 30, 1934. A month later a spine fusion from the sacrum to the twelfth dorsal vertebra inclusive was done. Following these procedures the patient's chief difficulty in walking lay in her lack of triceps power. She was unable to thrust down on her crutches and used "triceps bands" on the

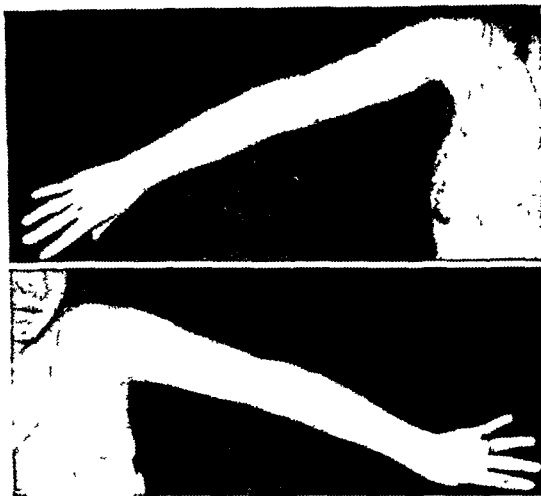
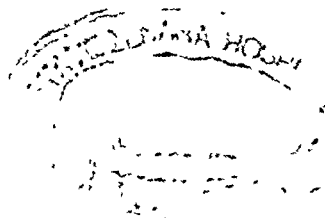


Fig 3 Photographs showing results in patient, V P

crutches to keep her elbows locked in extension. On November 20, 1936, the right brachioradialis muscle was transposed after the technique described and 2 weeks later a similar operation was performed on the left arm. Convalescence was uneventful. She gained rapidly in extensor power of the elbows. She was last seen in August, 1937. At that time she walked with much more facility than at any previous time. She had discarded the triceps bands from the crutches and was able to extend her elbows against gravity and some resistance whereas before the operation the triceps were rated poor bilaterally (Fig 3).

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RETROPERITONEAL PARARENAL OSTEOOMA

HERMAN L. KRETSCHMER M D, F A C S, Chicago, Illinois

RETROPERITONEAL tumors are relatively uncommon in comparison with tumors occurring in other parts of the body. Articles dealing with this subject are generally concerned with the reporting of a single case, although in a few instances the author has been able to record more than one case. This type of article is the exception.

Goebel reported 3 cases of retroperitoneal tumors and presented a very exhaustive review of the literature. He was able to collect a total of 101 cases. More recently Schmid tabulated a series of 267 cases. In all these tabulations, no case was found similar to the case I am about to report.

The finding of a retroperitoneal pararenal tumor composed of bone is an extremely unique experience and stimulates interest in the possible method of its origin.

CASE REPORT

Mrs. W., 63 years of age, referred by the late Dr. Donald P. Abbott. Patient first entered the Presbyterian Hospital on December 13, 1925. Last admission was on February 23, 1934. Between these two periods she had twelve other admissions. During this time she was treated for spastic and fermentative colitis, diverticulitis and chronic diverticulosis of the colon. There were no symptoms referable to the urinary tract at any time during the 9 years she was under observation.

A routine roentgen ray examination of the urinary tract was made at the time of the first admission to the hospital. This showed a very dense shadow, sharply defined, slightly nodular in outline, approximately oval in shape and measuring $7\frac{1}{2}$ centimeters in its longest diameter and 5 centimeters in its widest. This shadow was in the upper part of the left side of the abdomen at the level of the first and second lumbar vertebrae with its long axis perpendicular to the spine, its outer tip overlying the eleventh and twelfth ribs. The medial margin of this density lay 3 millimeters from the tip of the left transverse process of the first lumbar vertebra (Fig. 1). On lateral view this shadow overlies the body of the second lumbar vertebra—covering the posterior $1\frac{1}{3}$ thirds of this vertebra and spinal canal backward to the base of the spinous process. In this projection this shadow measured 5 by $5\frac{1}{2}$ centimeters (Fig. 2).

During the 9 years that she was under observation repeated blood Wassermann tests were all negative and severe basal metabolic rate determinations were always within normal limits. Many urinary examinations were made on each of her fourteen admissions to the hospital and they were all negative.

Table I gives the various blood chemistry examinations. A cystoscopic examination was done on May 14, 1927. The bladder was normal; the ureters were catheterized

without difficulty or obstruction. The urines from the right and left kidneys, as well as from the bladder, were free of pus, negative with Gram's stain, sterile on culture. Smears for tubercle bacilli were negative as were guinea pig inoculations for evidence of tuberculosis. Subsequent examinations for tubercle bacilli were also negative.

A set of retrograde pyelograms were made and they were normal. A shift film with a shadowgraph catheter in place was made and this showed that the large shadow maintained the same relationship to the tip of the left ureteral catheter before and after the shift.

Several sets of intravenous pyelograms were made at various times during her stay in the hospital and they were all negative and gave no additional information. Because of the fact that there were no symptoms referable to this shadow, the negative character of the urological findings and because the shadow was found on routine examination and did not increase in size over a period of 9 years, operation was not advised.

The problem of determining the actual location and nature of the shadow producing body proved interesting and difficult; the location of the shadow was readily determined but its nature was not. The conclusion was reached that the shadow was not due to a stone in the kidney but that it was extrarenal and that it lay in or practically in the same body plane as the kidney and that it was either attached to or was just below the lower pole of the kidney.

The conclusion was based on the following facts: (1) In a shift film made with a catheter in the ureter there was no change in the relationship between the catheter and the shadow. (2) In shift films made with both retrograde as well as intravenous pyelograms there was no change in the relationship between the shadow and the pyelograms. (3) A lateral film showed the shadow over the spine.

The possibility of calcification in a cyst attached to the lower pole of the kidney was given due consideration—this was excluded because of the very dense nature of the shadow.

The patient's last admission to the hospital was on February 23, 1934, at which time a diagnosis of acute diverticulitis was made. A colostomy was performed by Dr. Vernon C. David on March 14, 1934. The patient died 6 days later on March 20, 1934.

The autopsy was performed by Dr. Carl Apfelbach and the anatomical diagnosis was: diverticulitis of the sigmoid portion of the colon; partial obstruction of the colon; spontaneous rupture of two diverticula; acute fibrinopurulent peritonitis; thrombophlebitis of the inferior mesenteric vein; slight jaundice; recent colostomy; acute retrogressive changes of the myocardium; liver and kidneys chiefly cloudy swelling; erosion of the lining of the esophagus by vomitus; aspirated vomitus in the bronchial tree; extensive hemorrhages of the lungs; diminution of lipid material of the adrenal cortices; generalized arteriosclerosis; calcified left perirenal mass (osteoma); cystitis cystica; varicose veins of the lining of the urinary bladder; adenomas of the liver; redundant transverse portion of the colon partially obliterated; left internal iliac vein chronic indurative aortic endocarditis.

Gross description. At the level of the upper pole of the left kidney and between the kidney and the spine inferior

From the Presbyterian Hospital, Chicago, Illinois.
Read at the annual meeting of the Western Surgical Association held in Indianapolis, Indiana, December 3-4, 1937.



Fig 1 Anteroposterior view Showing the presence of a large dense shadow opposite the first and second lumbar vertebrae



Fig 2 Lateral view The shadow covers the posterior two-thirds of the second lumbar vertebra and extends posteriorly to the base of the spinous process

to the adrenal gland, there is a hard, oval mass with maximum length of 6.5 centimeters and a maximum width of 4.8 centimeters (Fig 3). There is a fibrous capsule less than 1 millimeter thick attached to the underlying bone. This capsule is embedded in the surrounding perirenal adipose tissue. The only connection between the mass and the vascular system is through a minute vein about 1 millimeter in diameter that extends to the renal vein, and there are no attachments between this mass and any of the surrounding structures. The surface is irregularly nodular. The mass is split through its largest plane (Fig 4). The inferior two-thirds are composed of uniform grayish brown bone, in which there are only a few red regions representing small blood vessels. At the superior end of the mass there is also bone, but this contains many more minute spaces of reddish-brown tissue resembling marrow. The compact portion of the mass cuts with great resistance, being firmer than the compact bone elsewhere in the body. The mass weighs 105 grams.

Histology In sections through the inferior portion of the bony mass there are only occasional cancellous portions. The remainder is made up of compact bone with fairly well formed Haversian canals. The bony structure is mature (Fig 5).

In a section through the superior portion there are a number of spaces in which there is myeloid tissue with a few islands of granulopoiesis and erythropoiesis (Fig 6).

The finding of a retroperitoneal pararenal osteoma naturally arouses our interest in the question

of its possible method of origin. When considering the origin of this tumor, it is necessary to make a sharp differentiation between pure osteoma and cases of retroperitoneal pararenal new-growths, in which bone formation has been found.

A case belonging to this latter category was recently reported by Hansmann and Budd (4). One of their cases showed extensive bone formation in a tumor, the structure of which resembled the adrenal gland.

In my case, tumor was composed only of one kind of tissue, namely, bone.

Ewing observes that in dealing with a circumscribed overgrowth of bone "the distinctions between inflammatory and neoplastic hyperplasia of the tissue are often so obscure that it has never been possible to define exactly the limits of osteoma. True progressive neoplasms which adhere to

TABLE I—BLOOD CHEMISTRY

Date	Serum Ca	Serum P	Urea N	Uric acid	Creatinine	N P N	Co	Sugar	As NaCl
4-2-26			16.8	3.9	1.3	38.3	40.0	108.1	515
5-14-27			16.2	4.0	1.3	33.5	64.5	90.9	514
11-27-28			19.0	5.7	1.7	36.5	59.8	89.7	455
8-9-29			22.7	5.7	1.8	36.3	60.7	131.6	493
1-16-30			20.0	5.3	1.4	43.2	65.5	104.7	484
3-28-34	12.6	6.1	14.8	5.7	1.4	33.3	61.4	95.2	530

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During the 9 years that she was under observation repeated blood Wassermann tests were all negative and several basal metabolic rate determinations were always within normal limits. Many urinary examinations were made on each of her fourteen admissions to the hospital and they were all negative.

Table I gives the various blood chemistry examinations. A cystoscopic examination was done on May 14, 1927. The bladder was normal, the ureters were catheterized

without difficulty or obstruction. The ureters from the right and left kidneys as well as from the bladder were free of pus, negative with Gram's stain, sterile on culture. Smears for tubercle bacilli were negative as were guinea pig inoculations for evidence of tuberculosis. Subsequent examinations for tubercle bacilli were also negative.

A set of retrograde pyelograms were made and they were normal. A shift film with a shadowgraph catheter in place was made and this showed that the large shadow maintained the same relationship to the tip of the left ureteral catheter before and after the shift.

Several sets of intravenous pyelograms were made at various times during her stay in the hospital, and they were all negative and gave no additional information. Because of the fact that there were no symptoms referable to this shadow, the negative character of the urological findings, and because the shadow was found on routine examination and did not increase in size over a period of 9 years, operation was not advised.

The problem of determining the actual location and nature of the shadow producing body proved interesting and difficult. The location of the shadow was readily determined but its nature was not. The conclusion was reached that the shadow was not due to a stone in the kidney, but that it was extrarenal and that it lay in or practically in the same body plane as the kidney and that it was either attached to, or was just below the lower pole of the kidney.

The conclusion was based on the following facts: (1) In a shift film made with a catheter in the ureter there was no change in the relationship between the catheter and the shadow. (2) In shift films made with both retrograde as well as intravenous pyelograms there was no change in the relationship between the shadow and the pyelograms. (3) A lateral film showed the shadow over the spine.

The possibility of calcification in a cyst attached to the lower pole of the kidney was given due consideration—the shadow was excluded because of the very dense nature of the shadow.

The patient's last admission to the hospital was on February 23, 1934, at which time a diagnosis of acute diverticulitis was made. A colostomy was performed by Dr. Vernon C. David on March 14, 1934. The patient died 6 days later on March 20, 1934.

The autopsy was performed by Dr. Carl Applebach and the anatomical diagnosis was: diverticulitis of the sigmoid portion of the colon, partial obstruction of the colon, spontaneous rupture of two diverticula, acute fibrinopurulent peritonitis, thrombophlebitis of the inferior mesenteric vein, slight jaundice, recent colostomy, acute retrograde changes of the myocardium, liver and kidney—chiefly cloudy swelling, erosion of the lining of the esophagus by vomitus, aspirated vomitus in the bronchial tree, extensive hemorrhages of the lungs, diminution of lipid material of the adrenal cortices, generalized arteriosclerosis, calcified left perirenal mass (osteoma), cystitis, cystic varicose veins of the lining of the urinary bladder, adenomas of the liver, redundant transverse portion of the colon partially obliterated, left internal iliac vein, chronic indurative aortic endocarditis.

Gross description. At the level of the upper pole of the left kidney and between the kidney and the spine, inferior

From the Presbyterian Hospital, Chicago, Illinois.
Read at the annual meeting of the Western Surgical Association held in Indianapolis, Indiana, December 3-4, 1937.



Fig 5 A photomicrograph of a section through the inferior two-thirds of the osteoma, showing mature, compact bone

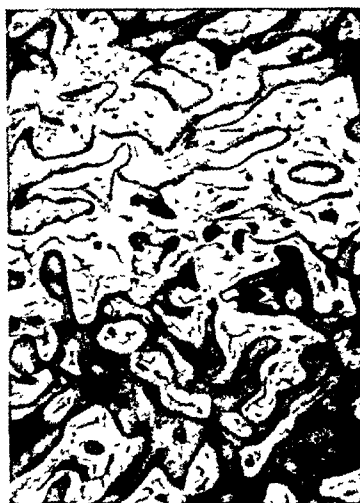


Fig 6 A photomicrograph of superior end of osteoma, showing irregular trabeculae and marrow spaces containing sparse numbers of granulocytes and erythrocytes

ducing bone (3) The third theory, making use of the doctrine of metaplasia, holds that any cell may, within certain tentative conditions, change its morphological features and become physically and perhaps chemically similar to other cells arising from the same general layer

Woolley feels that, of these theories, that of metaplasia is the outstanding one. He says that of the doctrine which "postulates embryonic rests there is no proof, save perhaps in rarest instances and in teratomas. There is no evidence that such remains play any part in the production of heteroplastic bone in any of the usual cases." He adds "that it seems to us that the logical explanation of practically all osseous heteroplasia can be found in the doctrine of metaplasia. "Metaplasia, it seems, being a physiological process of the widest possible application, must be also a process occurring under pathological conditions. The tissues of the body are formed by gradually changing steps that appear in response to physical and chemical conditions. There is no intrinsic embryological difference between the cells which are to form fibrous tissues and those which are to form bone. The variations which arise are the results of physical and chemical difference in the environment of the cells which make it necessary that different structures be produced, and of the two orders of environmental factors, the chemical is more important.

The author continues that it is not known how the necessary chemical conditions favoring osseous metaplasia are brought about. He says that E. R.

LeCount suggested that the presence of free blood plays a part in an unknown way, an interesting fact here being that heteroplastic bone is most frequently associated with trauma and with inflammatory changes which are in turn associated with hemorrhage. Woolley suggests that it is possible that the presence of red blood cells which are colloids of a certain concentration and composition furnish the proper physicochemical basis for deposition of salts in such concentrations that mesoblastic cells during the growth associated with organization are impelled in the direction of bone formation rather than toward fibrous tissue production.

Mallory notes that the occurrence in soft tissues of tumor, that is, masses containing bone and cartilage, has been recognized since the time of Rokitansky. The origin of such tumors has been the subject of a great deal of study, and Mallory states that the following three theories appear to be worthy of consideration: (1) *The neoplastic origin* of these tumors Mallory feels should be discarded except in certain frankly malignant cases. (2) *Origin from periosteum*, Mallory says, may be used to explain certain types of ossification of tendons, usually described as spur formation, and periosteal displacement may explain the so called myositis ossificans. This origin, however, does not apply generally. (3) *Metaplasia*. The origin by metaplasia from fibrous connective tissue was first suggested by Virchow. Mallory notes that Virchow believed that all bone and cartilage—both normal and abnormal—arose by metaplasia.



Fig. 3. Showing the kidney at the left and the bony tumor at the right

Virchow's criteria and in which bone is the essential and not the secondary or accidental product are not common but chronic processes which result in bone formation from trauma, inflammation, and disturbance of nutrition are numerous.

Ewing adds that even in cases in which the neoplastic qualities are least prominent (such as bone formation in necrotic tissue in the brain, eye, kidney or aorta in the floors of ulcer in the course of syphilis or tuberculosis), in the size of the resulting bony mass, the long duration of the process and its eventual independence of the original exciting factor occasionally there is revealed definite neoplastic characteristics.

According to Ewing histological study fails as a rule, to distinguish simple hyperplastic overgrowth of bone from true osteomas.

When the growth of bone is located in tissue other than bone it is termed heteroplastic.

HETEROPLASTIC BONE FORMATION

Ewing states that in heteroplastic bone formation the process begins either in a cartilaginous or a fibrous matrix. The cartilage becomes more vascular and ossification occurs about the small vessels through the activity of the osteoblasts. In connective tissue the stroma becomes hyaline, calcification occurs under the influence of the osteoblasts with the appearance of osteoid and finally osseous tissue. Here one must conclude



Fig. 4. A section through the largest plane of the osteoma showing the cancellous portion at the superior end and the remaining compact portion

that the process is metaplastic the fibroblasts acquiring the function of osteoblasts.

Ewing lists the following as factors which may be regarded as tending to call forth osteoblastic properties in fibroblasts:

- 1 Proximity to bone (Certain authors assume that bone formation always results from osteoblasts which have wandered out from the periosteum.) Ewing notes that this theory finds a certain support in myositis ossificans in which disease the process begins in the periosteum.

- 2 Presence of calcified deposits. These figure in many instances of ossification of necrotic tissue.

- 3 In active productive inflammation with organization of dead tissue and blood clot.

- 4 A special predisposition to calcification and ossification possibly connected with a disturbance of calcium metabolism must be assumed to exist in such cases as reticulated osteoma of the lung.

Woolley states that there are three hypotheses to account for heteroplastic bone formation: (1) The occurrence of embryonic rests of osteogenic tissue misplaced during development which in later years under stimulus of changed physiological conditions commence to grow and to produce bone. (2) A second theory postulates the transference of osteoblastic cells by way of the blood stream so that they arrive in unusual situations where they lodge (embolism) and grow pro-

embryonal structure. Such tumors are found both within and without the adult genito-urinary organs."

In a recent communication, Hansmann (5) again emphasizes the fact that spontaneous new-growths of bone, without evidence of previous injury to the surrounding tissue, occur in the pleura, the meninges, and in the retroperitoneal region. He says they attain a considerable size and considers them true neoplasm. He regards them as tumors of mesenchymal tissue that have taken on the function of bone formation without any obvious stimulus for their so doing, and he considers bone formation quite within the potency

of mesenchymal cells and does not consider them metaplastic.

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from fibroblastic elements Virchow regarded osteoblasts and chondroblasts as modified fibroblasts This doctrine of metaplasia in regard to bone and cartilage formation has been championed by Leriche and Policard to the extent that they regard osteosarcomas merely as fibrosarcomas, passively ossified by the local condition of their environment

Mallory summarizes his own opinion as follows "Not only does metaplasia offer a simple and satisfactory explanation for the ossification of muscles tendons, and ligaments, but it appears to be the only possible explanation of the many other types of heterotrophic bone formation constantly met by the pathologist, such as ossification of arteries heart valves pericardium and pleura, of obsolete tuberculous foci or of the falx cerebri to mention only the commoner types

Mallory concludes that many apparent bone and cartilage containing tumors of soft parts are in reality of metaplastic rather than neoplastic origin He also concludes that certain bone forming spindle cell sarcomas of soft parts may be more logically regarded as fibrosarcomas with a metaplastic foci of osteogenesis than as true osteoblastomas

Haining and Poole report a case of 'osteoblastoma of the kidney, histologically identical with osteogenic sarcoma' They mention the perosteal, neoplastic and metaplastic theories of origin of bone occurring in soft tissues They favor the latter theory and state that 'the metaplastic theory of osteogenesis does violence to none of the ascertained facts and offers a rational explanation of the normal and abnormal production of bone' They are of the opinion that it is the only available explanation for the type of extra skeletal ossification which occurred in their case of renal tumor

Haining and Poole note the rarity of bone forming tumor of the kidney which they think is some what surprising in view of the apparent availability of calcium in the urogenital system and "especially in view of the numerous experimental demonstrations of a peculiar osteogenic proclivity in some of the urogenital tissue

In the light of our present knowledge and after reviewing the theories presented by various authors previously noted in this paper, the origin of this tumor may be discussed under the following headings

1 The tumor might be the end result of the organization of an inflammatory process in the pararenal area or it might be the end result of the organization of a hemorrhage, the result of

trauma The history of the patient as reported in this paper furnished nothing to indicate that such an inflammatory process or a hemorrhage due to trauma had ever existed

2 The second theory is the one that postulates the transference of osteoblastic cells by way of the blood stream so that they arrive in unusual locations where they lodge (embolism), grow, and produce bone This seems rather far fetched in trying to explain the origin and location of the tumor under discussion

3 A remote possibility, and one which would be difficult to demonstrate with certainty, is that the bony mass in this case might represent metaplastic bone formation in a fibrosed accessory kidney Against this theory, one may mention the fact that no evidence was found at autopsy that this patient ever had an accessory kidney, or to be more specific, no evidence of an accessory renal pelvis ureter, or blood supply was found

4 In view of the fact that a very thin delicate strand of connective tissue containing delicate blood vessels was found one was led to speculate on the possibility that the tumor arose from the renal capsule as a fibroma grew downward, never lost its very thin connection with the kidney capsule, and subsequently underwent metaplasia resulting in the formation of an osteoma

5 Still further along the line of metaplasia may be mentioned the possibility that the original tumor was a retroperitoneal fibroma or lipoma that underwent complete ossification

6 It would appear reasonable to interpret the tumor described in this paper as a simple mixed tumor, the result of the development of an embryonal rest

Ewing states that the term mixed tumor is now confined to comparatively simple, chiefly embryonal growths, of purely local origin resulting from the overgrowth of embryonal structures with or without displacement

Ewing further states that most of the accepted forms of mixed tumors do not contain derivatives of three germ layers but are bidermal or monodermal

In this case the origin would be monodermal probably from the fibroblasts of the mesothelium or the urogenital fold

In this connection Hansmann and Budd state 'The potency of mesothelium has been appreciated since it has been established that synovial and pleural tumors produce bone fat fibrous tissue angiomatous tissue, and glandular tissue We assume that this might account for many of the mixed tumors with no particular characteristics which will associate them with a more definite

embryonal structure Such tumors are found both within and without the adult genito-urinary organs "

In a recent communication, Hansmann (5) again emphasizes the fact that spontaneous new-growths of bone, without evidence of previous injury to the surrounding tissue, occur in the pleura, the meninges, and in the retroperitoneal region He says they attain a considerable size and considers them true neoplasm He regards them as tumors of mesenchymal tissue that have taken on the function of bone formation without any obvious stimulus for their so doing, and he considers bone formation quite within the potency

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AMPUTATION STUMP OF ARTERIOSCLEROTIC GANGRENE

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IT is the purpose of this study to compare the mortality and morbidity in a series of patients suffering from gangrene of the lower extremity. The series deals with gangrene resulting from arteriosclerosis with and without diabetes. It deals primarily with the operative procedure which was attempted upon these patients. In so doing it is not meant to minimize general or systemic factors which in themselves may determine whether the patient is to live or die but rather to focus attention upon certain local factors which are too often overlooked or disregarded.

GENERAL CONSIDERATIONS

More specifically the question at hand is whether a primary fascial layer closure of the stump is justified in this type of gangrene. It is desirable to know what percentage of stumps so treated heal promptly. Also if wound healing and mortality are not satisfactory in the majority of cases following primary stump suture, is the simple chop amputation with secondary closure more desirable?

In the first place the mortality in arteriosclerotic gangrene with or without diabetes, is exceptionally high. The average figures as reported in the literature approximate 30 per cent. Some reports run considerably above this as is the case in the present series. Others such as McKittick's (4) in reporting diabetic arteriosclerotic amputations, are considerably lower (15 per cent). These lower figures are certainly the exception, and we must face the situation that in general the average hospital mortality in this type of case is at least 30 per cent.

It is quite evident then that with this extremely high mortality the operative procedure should be concerned primarily in saving the patient's life. Of secondary importance is the type of weight bearing stump which will result. In other words in the majority of these cases with gangrene of the lower extremity, the original operation should be one which insures the greatest safety and the least hazard. If the patient survives and the stump is not satisfactory, a secondary revision may be car-

ried out when the patient is in better general condition.

Of course, it is highly desirable to obtain a good weight bearing stump at the first operation. To this end the operator attempts to close the stump in anatomical layers over the exposed ends of the tibia or femur. In effecting this fascial layer closure the operator markedly impairs the circulation of the stump tissues—tissues which already are partially devitalized by their decreased blood supply. He also has placed in this devitalized zone varying amounts of constricting suture material. This materially aids any latent infection which may be present.

Such an anatomical closure, far too often results in necrosis and infection of the stump. This delays healing and frequently adds a sepsis which directly or indirectly leads to the patient's death. There are some cases in which primary closure is a perfectly safe procedure. From the results of the present series and the reports of others (1, 2, 4, 5, 6) it would seem that these cases are in the great minority. The only patients in whom it is safe to close the stump in anatomical layers are those having an ample blood supply with little or no infection about the gangrenous area. In these the blood supply is more readily determined than the factor of infection. The zone about a gangrenous toe may appear perfectly benign only to harbor streptococci in the fascial planes which cause an immediate flare up following operation. It is needless to say that if such is the case, the patient has a far better chance of survival when the wound is left open without tension than when it is closed over in a fascial layer type of suture.

Believing that the patient's life rather than his stump should receive first consideration it is astounding that so much emphasis has been put upon the different possible types of amputation. Two well known Systems of surgery carry an aggregate of nearly four hundred pages describing various forms flaps, and levels at which amputation may be attempted. Most of these would require an unusually good blood supply to succeed and are quite valueless in the arteriosclerotic extremity.

Because of the hazards of primary anatomical closure of amputation stumps and because these

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cases are poor operative risks at best, Crossan has recently advocated the simplest type of chop amputation. This is followed by a revision of the stump several weeks later. Crossan points out the fallacies of dissecting stump flaps thus separating one layer from another at the expense of its blood supply.

Leriche and also McKittrick (4) advocate merely a guillotine chop amputation where there is any evidence of infection. The stumps are left wide open thus effecting maximal drainage and minimizing the possibility of sepsis. It should be noted that McKittrick's mortality of 15 per cent for diabetic gangrene is the lowest recorded in recent literature. These writers follow the original operation with a secondary operation. At times this merely consists of bone amputation at a higher level.

The question naturally arises as to the dangers of at least a trial of primary suture. If this fails, the stump could be opened to allow better drainage. It is generally conceded that if primary suture fails, the situation is far worse than if no closure had been done since sepsis too often has gained a foothold that a debilitated patient is quite unable to meet. In the experience of McKittrick and Pratt (3) half of the postoperative deaths are due to infection. This is quite in agreement with the present series. Therefore, it is felt that the risk involved in trying to obtain a nice weight bearing stump at the first operation is seldom justified.

MATERIAL

The material for this study consists in 152 consecutive admissions for various types of gangrene of the lower extremity. The patients were cared for at the Indianapolis City Hospital and the Robert W. Long Hospital in the 7 year period from 1930 to 1937. Of these 152 cases, 109 had 131 major amputations.

As is the case in all general surgery services, the great majority of these amputations were for either arteriosclerotic gangrene or diabetic arteriosclerotic gangrene. In the present series these two entities were responsible for 88 per cent of the amputations for lower extremity gangrene. In order not to confuse the issue these two types alone will be considered—arteriosclerotic gangrene with and without diabetes.

In considering the aspects of wound healing, these two conditions will be dealt with together. This seems perfectly logical since the local vascular and pathological problem is the same. The diabetic patient has the added burden of diabetes. In so far as the local lesion is concerned, this is important only when the diabetes is out of control. Local infection is a threat in both conditions.

The remaining cases were those in which amputation was done because of one of the following conditions, arterial embolism and thrombosis, venous thrombosis, thrombo-angitis obliterans, and frost bite. The mortality of this group as a whole proved to be quite similar to that of the arteriosclerotic groups. The same is true of the wound healing of the amputation stumps. However, these cases constitute too small a group from which to draw accurate conclusions. They, therefore, have not been considered.

MORTALITY

A. In the diabetic arteriosclerotic gangrene group 77 major amputations resulted in 30 deaths, a mortality of 38.9 per cent. These deaths occurred in 65 cases, giving a case mortality of 46.1 per cent. As might be expected the mortality was even higher in those patients showing local or systemic evidences of infection. In 33 patients having local cellulitis, lymphangitis, adenitis, or leucocytosis, there were 20 deaths, a mortality of 60.6 per cent.

There were 23 cases of diabetic arteriosclerotic gangrene in which major amputations were not done. These do not represent all the cases in which palliative treatment was tried. Others were followed by extremity amputations. Of these 23 cases, 8 died (34.8 per cent). In all but one of these deaths infection played an important rôle. Of the surviving 15, there were 11 which healed completely after a protracted stay in the hospital while 4 were discharged with open draining wounds having little hope for local cure.

B. In the arteriosclerotic gangrene *without* the complication of diabetes there were 37 major amputations and 10 deaths (27 per cent). These deaths occurred in 29 cases, giving a case mortality of 34.5 per cent. Infection of the extremity was an important factor in 3 of the deaths. The 7 remaining died as a result of systemic vascular disease, embolism, or pneumonia. There were 9 arteriosclerotic gangrene cases in which operation was not done. Of these 6 died from other vascular disease. Healing occurred in 1 case, and the 2 others remained unchanged during the period of observation.

STUMP HEALING

As previously indicated the arteriosclerotic gangrene with and without diabetes has been combined for study of the stump healing. Also no differentiation has been made between leg and thigh amputations.

When an operator carefully prepares skin flaps and closes these and the underlying muscles over

TABLE I—FASCIAL LAYER SUTURE OF STUMP
USED IN 80 CASES OF ARTERIOSCLEROTIC
CANCRENE WITH AND WITHOUT DIABETES

	Cases	Per cent
Deaths in hospital	35	43.7
Deaths directly or indirectly due to infected non healing stump	17	21.2
Stump necrosis and suppuration (secondary healing)	9	36
Prompt healing	16	20

TABLE II—HOSPITAL MORTALITY FOLLOWING
OPERATION

	Cases	Per cent
Fascial layer stump closure	80	43.7
No suture secondary closure	12	25
Loose skin closure only	22	22.7

the femur or tibia in a fascial layer closure, he obviously expects to cure the patient and obtain prompt healing in the majority of instances. If he did not have this expectation, he would most certainly change his procedure. It is startling, therefore, to compare these expectations with the actual results as found in this series. These are given in Table I.

Here it is seen that of 80 attempts at primary fascial layer suture, prompt healing was obtained in only 20 per cent of the cases. Presumably, this procedure was done in the more favorable cases of the series since loose skin suture or secondary closure were used on the remaining cases of the series. With this small expectancy of prompt healing (20 per cent), it seems very doubtful that the surgeon should even consider fascial layer closure in any but the most favorable case.

It is further noted in Table I that the carefully repaired stump became infected or necrotic in over a third (36 per cent) of the cases. This necessitated in most instances opening up the stump to relieve tension and give more adequate drainage. In this connection it is also noted (Table I) that nearly one half of the hospital deaths were directly or indirectly the result of the infected stump. This latter figure is in keeping with the experience of McKinnick and Pratt.

A comparison of the mortality following the various types of stump closure is given in Table II. It is fully admitted that the cases cited are too few. Also a comparison based only on the operative procedure alone is invalid. However, the differences in mortality are so striking that they are given for whatever they may be worth. The second and third procedures listed (loose skin closure or no closure of the stump) are those generally reserved for the more severe cases while fascial layer

TABLE III—AVERAGE POSTOPERATIVE HOS-
PITAL DAYS OF SURVIVING PATIENTS

	Days
Fascial layer stump closure	50.0
No suture secondary closure	59.5
Loose skin closure only	41.3

closure is usually used for the better risks. Notwithstanding this Table II would seem to indicate a definite added risk in the anatomical type of stump closure.

HOSPITALIZATION

Of secondary importance from a medical standpoint and of prime importance economically is the time which the patient must spend in the hospital. No doubt it is with the hope of prompt early wound healing that the surgeon adds an extra suture to fascia or skin. Yet it may be this added suture which actually defeats the purpose for which it was intended by decreasing an already impaired blood supply, by increasing the chances of infection, and by preventing adequate drainage.

It was of interest then to compare the three general types of stump closure in relation to the postoperative days spent in the hospital. This is given in Table III. It is worthy of note that one of the chief goals of the fascial layer stump closure was not achieved in that the average postoperative hospital days were not diminished. They were in fact definitely increased over the more simple procedure of loose skin closure.

TOURNIQUET, DRAIN

From a theoretical standpoint, the use of a tourniquet is undesirable in so far as the stump tissues are concerned. However no great difference was noted in this series. In those cases in which a tourniquet was used 45 per cent of the stump wounds became necrotic or infected while 34 per cent followed this change when no tourniquet was used. Embolism and death followed the use of a tourniquet in 4 patients. In an equal number of cases a tourniquet was not used and in these embolism occurred twice with one case resulting in death.

The part played by rubber drains inserted into the stump was also studied. This led to no definite conclusion as to their value. The drain allows an exit for the inevitable accumulation of blood and serum in the sutured stump. In so doing it acts as a foreign body tempting infection. Once the stump does become infected it is dangerous to rely upon the drain alone without removing sutures to allow a more adequate drainage.

CONCLUSIONS

From the foregoing it would seem that primary anatomical fascial layer closure of the amputation stump of arteriosclerotic gangrene is a risky and uncertain procedure. This is true whether or not diabetes complicates the picture. The above operation should be reserved for the exceptional case with ample vascularity and no infection. These ideal conditions are not found in the large majority of cases with arteriosclerotic gangrene.

It is recommended that the simple circular amputation advocated by Williams and O'Kane and others (1, 2, 3, 6) be used in all but the occasional case. This consists of a circular skin incision (at the site of choice) carried down to the bone through the muscles at the level of skin retraction with no separation of skin or fascial planes. Gentle retraction will allow bony amputation at a higher level. In cases in which infection is a definite hazard, any attempt to close the stump adds to the chances of complications and most certainly does not save time. When in doubt, the writer has frequently placed a few untied silk-worm gut sutures through the skin and underlying fascia. If the case progresses satisfactorily these may be tied 5 days or a week later. In other instances in which infection is only a slight threat, loosely placed interrupted skin sutures are definitely indicated. These allow the discharge of serum without producing any constriction.

A valuable operation in the extremely septic patient with an uncontrollable diabetes is disarticulation at the knee joint. This has the advantage of simplicity and opens up no new fascial planes to the spread of infection. Further it disturbs the vascularity of the remaining stump to a minimal extent. Of course, a reamputation at a higher level must be done later.

SUMMARY

1 Arteriosclerotic gangrene with or without the complication of diabetes has an extremely poor prognosis.

2 The operative mortality in these cases in which major amputations are done, in the present series, was 39.6 per cent.

3 An analysis of the mortality is made in relation to the operative procedure and the frequency of postoperative stump infection.

4 It is shown that the anatomical skin flap fascial plane closure of the great majority of stumps (a) definitely increases the operative hazard, (b) does not decrease the morbidity or shorten the average postoperative stay in the hospital, and (c) results in a surprisingly small proportion of promptly healing wounds (20 per cent in present series).

5 Approximately one-half of hospital deaths are due directly or indirectly to necrosis and sepsis of the amputation stump. The remainder are the result of cardiovascular disease or pneumonia.

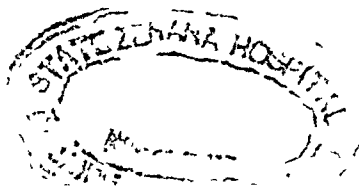
6 It is, therefore, suggested that primary consideration be given to the patient's life rather than concentrating on a more perfect anatomical stump.

7 It is recommended that the anatomical fascial plane suture of the stump whether in the leg or thigh, be reserved for the exceptional case with no complicating infection and with an adequate blood supply.

8. The great majority of amputations in this disease are more safely done by the simple circular amputation without dissection of flaps. If infection is a hazard, no advantage can be gained by attempting to close the stump with sutures. This only adds to the risk and in the usual case does not hasten healing. When the danger from infection is slight, a few loosely placed interrupted sutures in the skin only, are definitely indicated. Layer suture over the bony end of femur or tibia impairs an already poor circulation and greatly increases the risk of infection and sepsis.

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PITFALLS IN SURGERY

CORRELATION OF OPERATIVE PROCEDURE WITH MECHANICAL FACTORS

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THE late Dr. Morris H. Richardson, a leading surgeon of his time, wrote early in this century a series of invaluable articles in the *Boston Medical and Surgical Journal* based on unsuccessful surgical procedures in his own clinic. I am very sure that the perusal of them must have stimulated countless younger men, as they did me, to shun the numerous pitfalls which he so dramatically portrayed. We have without doubt, all of us, had at times undesirable outcomes which, if publicized, might have proved more helpful to our colleagues than could any reports of the expected results that crowned well directed efforts. With this in mind I shall refer briefly to some of the pitfalls which I have not been able uniformly to avoid—they are at least in the background of all the therapeutic suggestions that follow.

DIRECTION OF INCISION VERSUS ACCESSIBILITY, CLOSURE AND HERNIA

Mrs. K., 39 years of age, seen at office October 6, 1932. Her present complaint was pain high in the right abdomen. She had had the appendix and gall bladder full of tiny stones removed 6 years previously through the conventional right rectus incision. She has had three major attacks of cramping pain in upper right abdomen during past year which required hypodermic after which stools became clay-colored and skin jaundiced for a week or two, urine meanwhile being dark and irritating.

Physical examination revealed weight 212 pounds, tender high right abdomen with respiratory inhibition, perineum badly torn, cystocele, cervix low, back body of uterus forward and of moderate size. Diagnosis: common duct stone.

On October 13, weight was 205 pounds as result of reducing diet and 2 grains of thyroid extract daily. Now recommend exploration of bile ducts.

On October 20, patient entered Missouri Baptist Hospital. On October 22, operation was done. Through a high right transverse incision, prolonged several centimeters beyond the midline, we had great difficulty in localizing a very thick walled common duct. It was opened, probes were inserted into the hepatic duct although we were unable to introduce them into the lower end of common duct and duodenum. No stone was discovered. A catheter was sewn into the hepatic duct. Penrose drains were attached to same region and the transverse wound was closed in layers up to them. (We surmised there was a structure low in the common duct though patient's condition at the time pre-

cluded any further operation.) Her convalescence was uneventful.

On December 6, patient reported at office in fair condition though complaining of her pre-operative symptoms. Weight was 180 pounds. There had been no drainage through the catheter since she left the hospital, hence it was removed.

On March 29, 1933, we discovered a hernia in almost the entire extent of the transverse wound. The oblique muscle could be plainly felt. There was cough and strain impulse and great bulging when she was in standing posture. (She had been nauseated after having taken 10 grains of sodium phenobarbital before going to the operating room. After exploration of the common duct she vomited five times in first 24 hours and two to three times daily thereafter for 6 days again on the ninth day. We think that continued vomiting in this case was the important direct factor that interfered with healing.)

On May 10, we advised repair of hernia.

On May 23, re-operation. Transverse colon was found lining the ring and firmly attached to its margins. The layers of the wall which constituted the ring could not be easily identified and separated, hence one deep suture layer was constructed with catgut, being reinforced with two layers of autogenous fascia lata sutures.

On June 26, the region of the operation scar was perfectly solid, patient had no more complaints, was eating everything except restricted foods.

On August 3, weight was 162 pounds. The abdominal wall was perfectly solid, bowels regular, stools brown in color, right upper abdominal symptoms missing, hence it is probable that the hernia, rather than a bile tract malady, was responsible for her recent symptoms. Patient was advised to increase her activities up to the fatigue limit.

This type of incision has particular advantages where an obese patient presents a very wide costal angle. This is more especially true if there be reason for extending the incision which may without serious objection reach from one costal margin to the other. I have found it particularly effective in removing a damaged spleen as well as in exploration of deep seated common duct lesions. This is just the type (wide angle) of patient in whom paramedian incisions are difficult to close on account of the inspiratory pull on the lateral wound edge due in part to the fact that many of them are plethoric and short of breath under ordinary circumstances. The margins of the cross incision on the other hand tend absolutely to drop together no matter what the respiratory effort. We have had occasional incisional hernias through

such wounds, as in case quoted, but they are extremely easy to close in the second instance for the same reason that held good for the first: it should be remembered in this connection that the abdominal wall (incision) is but one factor in the production of hernia. The much more important one is seen in increased intracorporal tension accounted for usually in one of five ways. (1) interference with the functions of bodily orifice—respiratory difficulty, vomiting, distention, dysuria, (2) gain in weight; (3) pregnancy, (4) abdominal tumor, (5) ascites

I do not recommend this incision for the patient with a *narrow costal angle* because one gets more room here by proceeding in the conventional manner, furthermore, this type is never endowed with flat muscles strong enough to exert the maximum cross pull on the wound lips.

EVENTRATION WITHOUT CLOSURE, RECOVERY

Dr U, 47 years of age, entered Missouri Baptist Hospital July 9, 1926, complaining of indigestion and pain in right abdomen. The present illness began 2 years ago with repeated attacks of indigestion and pain in right abdomen; the latter became worse 2 days ago, was more severe and tended to localize in the lower right quadrant.

Physical examination revealed nothing especially abnormal in temperature, pulse, blood pressure, and respiration, white blood cell, 12,600. A palpable mass the size of a lemon was noted in the right lower quadrant, very tender with positive Meltzer sign. Much fat was present in the abdominal wall, and patient had a double inguinal hernia.

Diagnosis Subacute appendicitis, double hernia.

July 13, operation. We made a right rectus incision, found the head of the cecum plastered to the pelvic wall. After freeing it we succeeded in removing a short, thick, completely adherent appendix which contained three enormous stones. Its removal left a small opening in the colon wall, which was closed as well as rigidity of the wall permitted, fat tabs being attached to the site, three soft rubber drains were left in place and the firm layers of the abdominal wall sutured above and below them in layers.

On July 16, the drains were removed. Patient was nauseated and there was a large amount of foul drainage, some blood. He was expelling gas freely.

On July 21, (eighth postoperative day) there was pain in the wound, a thin, bloody drainage. A large amount of intestine was found protruding through the wide open incision, on account of patient's rather desperate condition it was wrapped in thin rubber dam, a firm dressing applied over it, but no attempt made to resuture the wound.

On July 29, the mass of intestine had partially retracted into the abdominal cavity.

On August 2, the intestines were receding still further.

On August 10, adhesive strap compression was placed on the extruded mass.

On August 10, the entire mass, the size of one-half grapefruit, was skin grafted.

On August 27, patient was up in a chair.

On September 3, additional skin grafting was done over areas not yet covered.

On September 16, patient went home.

June 1, 1928. A letter was received from patient regarding a detail of his medical practice, and although he did not mention his condition this proves at least he was alive and

at work. (He is listed in the 1937 *American Medical Directory* as being in active practice.)

Spontaneous disruption of a laparotomy wound is frequently predictable and preventable. It might well have been anticipated in this man who was excessively fat, same would hold good for a patient with ascites, as it would for a pregnant woman or, indeed, for any individual who is vomiting, having respiratory difficulty, straining at stool, or when passing urine. We are forced in an emergency to operate immediately on certain individuals well within the above classifications, hence then no choice is left us but to risk eventration. However, one must admit that it does occur very frequently in those who could well have been subjected to pre-operative treatment for the correction of the factors which underlie its occurrence.

A mortality of about 35 per cent accompanies this accident. It certainly is due in part only to the disruption itself which can be easily repaired, but is likely caused rather by fundamental conditions above alluded to which produced the accident in the first place.

My teacher, Madelung of Strasburg, studied the reports of 157 such cases and found that wound disruption occurred wholly irrespective of the suture material inserted. What is more, the method of wound closure had little if any influence in preventing the accident. It is worthy of note that many of the individuals in which the disruption was not reclosed at all progressed about as well as those which were closed. In such instances the extruded viscera were merely kept covered up to the end that in most cases they retracted spontaneously completely within the abdominal cavity. Strange to say, in some no hernia resulted, though this is almost inconceivable.

Bursting of the wound frequently is marked by an expression of relief on the patient's part. This entails interesting physiological implications. May not the accident give much needed relief of intracorporal tension and may we not by the same token damage the patient by secondary closure which re-establishes this pathological hypertension? I am not trying to lay down a general rule but merely reciting the above experience of a patient in whom the disruption was not closed at all, one who recovered completely.

PALLIATIVE OPERATION IN POOR RISK PATIENT

Mr C, 50 years of age, entered Missouri Baptist Hospital July 9, 1928, with complaint of cramping pain high right abdomen. Patient had over eaten and has been short of breath for several years, his heart being considered at fault. He had never been jaundiced. The onset of present cramps was 2 days ago, with nausea,

Physical examination revealed patient cyanotic short of breath abdomen distended and very tender over entire right side iodoikon intravenous injection demonstrated a pathological gall bladder

Diagnosis acute cholecystitis and myocarditis

On July 9 operation was done Under infiltration anesthesia we found a thick walled gall bladder which could not be mobilized tightly filled with stones A small amount of purulent fluid was aspirated The gall bladder was opened and the mucous membrane was found to be completely gangrenous A few stones were removed The gall bladder was attached to abdominal wall with two stitches and packed with gauze A small amount of gauze was used to wall off the free peritoneal cavity Gauze pack was removed at the end of 1 week The patient's symptoms were completely relieved

On December 5 the wound was still draining digestion was perfect and bowels were normal

March 20 1929 since last follow up note the drainage opening has healed over several times then bulged become tender and the thin skin ruptured with discharge of a few stones today a very few small ones are found on his dressing

One step of a two-stage (complete) procedure may be all as in this instance, that is required to keep an elderly sufferer with damaged heart in fair health during the period of his normal life expectancy during which time the completion of the procedure might be most hazardous no matter when attempted I am informed that this gentleman lived for several years succeeding the date last given but never had any further local symptoms of importance

TECHNIQUE OF GALL BLADDER DECOMPRESSION, SECONDARY REMOVAL

Mrs C 62 years of age entered Missouri Baptist Hospital June 27 1930 with complaint Misery in upper abdomen For the last 4 months patient has complained as above noted the pain being relieved by vomiting At times pain radiated to the right shoulder Chill was followed by jaundice of several days duration Temperature now was 104.6 degrees

Physical examination revealed muscle tone greatly increased particularly in high right abdomen which was tender to touch Abdomen was tense Diagnosis gall stone disease

On July 5 operation was performed Through a tiny gridiron incision parallel to right rib margin rather far out we drew end of gall bladder upward stitched it to peritoneum, flooded wall with alcohol packed periphery of wound with gauze opened gall bladder inserted large catheter This fell out few hours later and was replaced by a mushroom catheter

On July 8 gauze was removed without difficulty or bleeding

On July 15 patient was walking around the hospital eating well gaining strength The gall bladder was draining well into the receptacle little discharge around the tube

On July 20 I was called to patient's home to replace tube A small faceted stone had followed its expulsion

On September 9 patient seems perfectly well and is free from jaundice

On October 8 patient is passing much bile through tube

stools are clay-colored and she has had a few sharp attacks of epigastric pain

On November 18 patient was re-operated upon A high incision was made close to the midline (as far as possible from the drainage opening) The gall bladder appeared very little changed There were no stones in it or in the cystic duct The common and hepatic ducts were dilated and their walls were gray and thick The common duct contained in its pancreatic portion a few medium sized pigmented stones which were removed Its lower end was dilated A catheter was sewn into the hepatic duct, the common duct was closed and a Penrose drain was attached to suture line and brought out at the upper angle of the wound

On January 6 1931 lipiodol injection demonstrated the common duct open and draining freely into the duodenum

On February 5 stools were brown and no jaundice was present

On February 10 a second lipiodol x ray examination confirmed findings mentioned

On March 20 patient seemed perfectly well hence tube was removed from hepatic duct

On May 19 she was absolutely well

On July 26 1935 report indicates that she has remained entirely well abdominal wall is normal

As demonstrated by this patient a gall bladder which can be approximated to the peritoneum below the rib margin is satisfactorily decompressed through a tiny gridiron incision, well to the right of the line usually followed by inserting a mushroom catheter which stays in place until every evidence of subacute disease is past A new clean field close to the midline can be chosen for the radical procedure the gall bladder cut from the abdominal wall with a cautery, the ducts explored stones removed, lower end dilated later on lipiodol is injected but catheter not removed until ducts are proved to be clear Many lives should be saved by a two-stage procedure in gall stone patients seriously handicapped when first seen

ONE ERROR IN JUDGMENT, A SECOND IN TECHNIQUE

Mrs W 51 years of age entered Missouri Baptist Hospital November 11 1929 with complaint of profuse protracted menstrual periods Her present illness began 3 months ago menstruation lasting 7 to 10 days She passed clots and has grown so weak she is unable to walk Hemoglobin was 50 per cent

Physical examination revealed a tumor the size of one-half hen egg projecting from the cervix uteri It bled on slightest touch seemed seminecrotic and exuded a characteristic odor A hard nodular low midabdominal tumor reached midway to the umbilicus

Diagnosis fibromyoma uteri

On November 16 she was transfused and subjected to operation A uterine growth the size of a coconut was found made up of large nodular masses one of which has been mentioned as projecting from the cervix total hysterectomy was done with complete suture of the vaginal wall as recommended by Wertheim A Penrose drain was left in the lower angle of the abdominal wound November 21 patient died of peritonitis and paralytic ileus

An error in *judgment* probably resulted in this woman's death. It would have been safer to evulse the cervical fibroid, cauterize the base, and devote several days to cleaning up the vagina. An error in *technique* is apparent in the light of more recent developments which have forced us to drain into the vagina in every such patient; since adopting this plan the morbidity in these cases has been greatly reduced, to say nothing of the much lowered mortality. We insert from above a $\frac{1}{2}$ inch split rubber tube with a flange which prevents it from slipping back into the peritoneal cavity. No sutures enter the vaginal mucosa in placing the loose purse-stringing suture around the tube. There are many instances like this case in which a definitely handicapped patient (unless life is at stake) should first be relieved of an incubus before remedial operation is undertaken—so much for judgment. As to technique, the brilliant Lawson Tait taught us long ago that any collection of fluid in the pelvis may become infected hence is a source of potential danger, so we now split the cervix in posterior midline, then insert vaginal tube after *subtotal* hysterectomy as well, although the total removal alone insures ideal drainage.

A ONE-STAGE COMBINED RESECTION OF THE RECTUM (BEGINNING BELOW)

Mr W, 50 years of age, entered Jewish Hospital March 4, 1932, with complaint of rectal trouble. He had noticed hemorrhoids a year ago. The stools were streaked with bright red blood 8 months ago. He had never had any other characteristic local or general symptoms. Two weeks ago a biopsy was made and patient was told that microscopic examination revealed cancer.

Physical examination revealed a large area of leucoplacia just behind the anus, digital examination revealed a partially ring-like mass about 4 centimeters from anal opening, apparently originating on the posterior surface and at the present time firmly fixed to its base. It was on a level with the tip of the coccyx. The anterior rectal wall was clear. The prostate was firm, of moderate size, smooth. The inguinal lymph nodes were barely palpable. Diagnosis: cancer of rectum.

On March 10, operation was performed. Through a left gridiron incision one of my associates cut the sigmoid in two, inverted and dropped back what he took to be the lower segment and implanted what he considered the upper segment in the small wound which was snugly closed about it.

On March 13, at 10 oop m the patient was found greatly distended, suffering with violent cramps and passing no gas. A right gridiron incision was made in the lower abdomen, the cecum was sutured to the parietal peritoneum, the viscus was incised, and an enormous amount of gas and feces liberated. A split rubber tube was fixed in place, and patient's symptoms were instantly relieved.

On April 6, we circumscribed the anus, removed the coccyx, and found suppurating fistulas running toward the posterior pelvic wall. These were stuffed with iodoform gauze and further attempts to remove the rectum were

abandoned, as a matter of course. (It is probable that the posterior rectal wall had been perforated at the biopsy done some weeks earlier in another hospital with resulting perirectal suppuration and fixation of the tumor.) While the patient was on the table we opened the midline, anchored a coil of distended sigmoid in the wall, opened it later and sent him home in a few days.

On July 5, he re-entered the same hospital where he died on July 9.

My combined one-stage resection (commencing below) was devised for the limited number of cases in which the tumor is found at operation to lie so high that it cannot well be mobilized and a satisfactory posterior resection completed. In the case under discussion, however, a new indication for this method is presented; namely, it enables one to determine local inoperability before doing major surgery within the abdominal cavity as first step in a combined operation.

My first successful resection of this type was done November 13, 1924. I presented the method before the Texas Surgical Society on February 4, 1930, and published a description of it in May of 1931. The following October Dr. Fred W. Rankin published a large number of cases in which the operation was begun from below and in subsequent articles greatly enlarged upon his experience. It is to him, more than to any other of numerous surgeons who have used the method, therefore, that credit is chiefly due for giving it the wide publicity which it seems to have attained.

TECHNIQUE OF HEMORRHOIDECTOMY, AFTER-TREATMENT

Mrs. C, 39 years of age, entered Missouri Baptist Hospital July 16, 1928, for treatment of piles and constipation. Her present illness, began many years ago with constipation. She has had painful defecation for 2 to 3 years. During that period the supposed piles have bled at frequent intervals. There is some bearing down feeling in the pelvis and much discomfort low in the back.

Physical examination revealed toward the midline, anteriorly, several external and a few internal hemorrhoids, one of large size, pelvic conditions are normal, there is nothing higher up palpated in the bowel. Diagnosis: hemorrhoids.

On July 19, operation was done. We removed three enormous internal hemorrhoids located over the three cardinal arteries, also two large skin tags, all done with cautery.

This patient never reported back though living not far away, it may be fairly assumed that the result was satisfactory.

It is most important that these patients "be prepared" during the week preceding operation by an antiputrefactive non-residual diet and mineral oil in small doses with each meal. There should be a cleansing enema the night before operation (none the morning of it if the operator is to avoid soiling himself).

We place such a patient on the side for operation with the uppermost leg strongly flexed and the corresponding buttock forcibly retracted by a strap of adhesive, in this way we gain an exposure which is surprisingly good. Skin tabs are to the patient the palpable, if not visible, evidences of his malady hence no matter what one accomplishes inside the sphincter the sufferer is prone to brood over 'sentinel piles' unless they too have been removed. Our first step is, therefore, to grasp each of them with a forceps draw them apart, introduce a tubular speculum through which the lower rectum is packed with gauze which, after the speculum has been removed is drawn slowly downward giving a remarkably good exposure of the hemorrhoidal area. After the internal tumors have been removed by any of the approved methods we are careful to clip off all the skin tabs to which forceps still are attached, then we smear the whole area with vaseline of high melting point employing no tube tampon or dressing unless there is uncontrollable bleeding which rarely occurs and which is usually to be blamed on faulty technique. The patient usually remains in bed 3 to 4 days, when he gets a warm sitz bath and is out of the hospital in less than a week if all goes well.

Antiputrefactive diet and mineral oil should be continued during the first 4 days succeeding operation. The ordinary lead and opium pill 1 grain each, should be given with every meal during this period. It is important that the patient refrain so far as is possible from coughing, sneezing or bearing down during his early convalescence otherwise a prolapse may occur which if it becomes edematous cannot be replaced completely for many days or even weeks. Bowel movements are not contemplated during the first 4 days and should not under any circumstances be more frequent than one or two a day during the first 2 weeks. Very frequently these patients cannot urinate following hemorrhoidectomy this complication should be carefully considered and met in the customary manner. While our patients are

usually up in 4 days, bed life is recommended for as long as 12 days in case much discomfort is caused by sitting or walking. There is a certain inevitable amount of gangrene and discharge lasting from 2 to 3 weeks hence a dressing will be needed when the patient is up. This is best applied in men by pinning a square of cotton inside the drawers at the exact point where they come in contact with the anus. Women will appreciate the ordinary pad worn during the menstrual period. During the first postoperative month (after the fourth day) a sitz bath should be taken after every bowel movement. If there be much edema nothing will shrink it like glycerine on cotton worn underneath the dressing mentioned. Constant mild heat gives more relief of discomfort and spasm than anything else in my experience. When sitting, especially in a car one should use an air pillow (not an air ring) for 4 to 6 weeks after operation. During this period hard feces will greatly irritate the wounds, hence I recommend the introduction of a cocoa butter suppository at night before retiring if needed in addition to the constant use of mineral oil. *Nothing else is inserted at any time.*

I have gone into such extreme detail on after treatment here because nothing of the sort can be found in the textbooks I have seen. This is considered a minor procedure too but the operation is frequent the need is widespread, and one who has learned by experience just how miserable he can become after this small operation will know how to appreciate what has gone before.

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SPONDYLOLISTHESIS

THE intensive study of the human spine, carried out by Schmorl and his associates with their great collection of postmortem material, has roused anatomists and surgeons to renewed and progressive interest in this difficult and too little understood portion of the skeleton. This interest has led, justly, to a review of older anatomical and clinical studies and brought to present consciousness the fact that our predecessors in medicine studied and recorded extensive observations on the anomalies, variations, and injuries of the spine as a whole.

Not the least interesting studies, from both the anatomical and clinical standpoints, especially in their adaptation to serious problems in low back pain and medicolegal tangles following trauma, have been the investigations of spondylolisthesis, spondylolysis, pseudo-spondylolisthesis, and fractures of the neural arch and laminae of the spine. The reports of Dwight, Willis, Goldthwaite, and Neugebauer have been restudied. The collection of over

one hundred instances of spondylolisthesis by the last named man in 1892, based principally on museum specimens in connection with obstetrical research, has been accorded recognition. Willis' thesis in 1922, at Western Reserve University, also aided in establishing a proper anatomical background for clinical and roentgenological observations of the disputed anomalies or traumatic lesions of the vertebral column. The condition first named spondylolisthesis by Kilian in 1852, although described as long ago as 1782 by Herbineau, now enters every day differential diagnosis of low back injury and pain. Active surgeons must recognize its not uncommon presence and follow the lead of those who, in recent years, have endeavored to apply surgical principles in treatment of this painful and disabling slipping of the spine, often not recognized until a traumatic factor has forced attention to it.

Even the latest methods of fixation of the spine by bone transplant applied across the back of the column, advanced by Mathieu and Demirleau in July, 1936, anchoring superincumbent spinal elements to the sacrum, have been amplified following the ideas of Capener, by more direct and possibly physiological attack on the slipping deformity. Resection of the intervertebral disc at the displacement level and its replacement by wedge-shaped bone graft or the use of an indriven, autogenous bone graft through the centrum of the fifth lumbar into the medullary portion of the sacrum via an abdominal approach have entered the field of assured surgical achievement. In 1932, Capener stated that he believed that "the technical difficulties of such a procedure, however, preclude their trial."

The reported instances of attempts at an anterior bony fusion of the spine to the sacrum, by resection and graft, or direct bone graft alone as done by Jenkins of New Zealand, Burns and Mercer of Great Britain, Friberg of Stockholm, and Kellogg Speed in the United States, who also demonstrated the possibility of steel nail fixation, may lead to accepted advance in the curative therapy of this condition

KELLOGG SPEED

PUS, THE FRIENDLY ENEMY

While putrid and corrupt matter is generating pain and agues rather happen that when it is already there' Sec 2-VII-p 56

Pus the thicker and whiter it is the less danger' Sec 13-VII-p 402

Aphorisms of Hippocrates and the Sentences of Celsus
—Sir Conrad Sprengell, 1733

THE development of a local tissue immunity was thus described about 450 B C Twenty two hundred and fifty years later, Jenner demonstrated to the world that man can acquire a general immunity to a disease Ninety two years elapsed between Jenner's demonstration of vaccination against smallpox and the discovery of antitoxin in the blood serum of immune animals by Behring, Wernick and Kitasato

The science of immunology, therefore, is less than half a century old Its contributions to medicine have resulted in an improved management of the infectious diseases with a marked reduction in mortality Immunologists and bacteriologists have made contributions to immunology as it relates to surgery which have improved the management of some of the acute lesions of the abdomen but in a great many lesions there has been no material reduction in mortality because of their observations

The identification of the *Clostridium welchii* and *Clostridium tetani*, the discovery of their toxins and the development of antitoxins have

helped surgeons manage patients with surgical lesions resulting from an invasion of these micro-organisms but the mortality caused by the various strains of streptococci, *Bacillus coli*, staphylococci, gonococci, and others of the endotoxin group has not been materially affected by the discoveries of those interested in this science

In the management of a spreading cellulitis surgeons have learned by trial and error that incising along the radiating lines of redness which clearly delineates the involved lymphatics, should never be done, that rib resection should not be done early in streptococcal pleuritis with effusion, that fallopian tubes should not be removed when the process is in the acute stage, that acute perforations of diverticula of the colon should be permitted to localize, that early pancreatectomy does not reduce the high mortality in acute processes involving that organ

This improved management, the substitution or replacement of the immediate by the delayed operation has developed gradually While the experience of surgeons has shown the way to a diminished mortality in the acute lesions mentioned, the mortality of a lesion that is older than the science of immunology—spreading peritonitis due to a perforated appendix—has not been materially affected

During the years of controversy among surgeons regarding the value of immediate or delayed operation for this disease, immunologists have failed to submit final evidence supporting either one or the other opinion A review of their contributions on work relative to the acute infections in man shows a justification however for the statement that patients recover from spreading peritonitis due to a perforated appendix just as they do from a cellulitis or a pneumonia by means of the development of a local tissue and a general immunity

There is no open road to an adequate conception of the processes or the part certain cells play in the development of immunity; the paths which lead to it, like the neutrophilic filled capillaries in acute inflammation, are crowded with conjectures, one of which is the part these early migrators play in the development of tissue and general resistance. The consensus among investigators is that while in some instances neutrophils alone are responsible for the development of a local tissue immunity and play a part in the development of a general immunity, larger cells, the macrophages, principally the clasmatoocytes, play the important rôle.

The local tissue changes to be described which accompany the invasion of normal tissues by micro-organisms is important, but it should be emphasized that these changes are modified by the existence of that which we call a natural resistance to infection which in many instances, is an acquired immunity to a single or a group of micro-organisms. For instance, if the *Staphylococcus aureus* is injected into the skin and subcutaneous tissues of the abdominal wall of normal guinea pigs, the capillaries are filled with neutrophils within a period of 4 hours. Shortly after they become arranged in intimate contact with the vessel walls and at the end of 10 hours, various stages of passage of the leucocytes through the walls of the finer vessels can be observed, later they appear in the perivascular spaces and surrounding tissues where they are massed around the invading microbes. Following this, the neutrophils begin to disintegrate, permitting proliferation of the micro-organisms. Clasmatoocytes are never seen in large numbers. The foregoing happens in the tissues of non-immune animals. If to other guinea pigs a local application of beef broth be applied to the skin of the abdomen for 48 hours, or if they have been previously immunized by

cutaneous injections of a live virulent culture of the *Staphylococcus aureus* and then given a lethal dose of *Staphylococcus aureus*, as early as 6 hours after injection, there is a proliferation of clasmatoocytes and fibroblasts with beginning organization and preservation of the integrity of the neutrophils. After 20 to 30 hours, the clasmatoocytes are acting as scavengers and at the end of 48 to 72 hours, a well walled-off abscess develops in the subcutaneous tissue. Cannon and Pachero believe that the immunity secured is due to the increase in number of tissue macrophages (clasmatoocytes).

In a histological study of postmortem tissue in man, Robertson and Wiley showed that resolution in lobar pneumonia is accompanied by an increase of large mononuclear cells; 90 separate lobe lesions from 40 patients were studied. Sections obtained from 6 patients dying at intervals of from 6 days to 2 months, following recovery from this disease showed a pronounced macrophage reaction in every instance. These authors observed that when a well developed macrophage reaction occurred, pneumococci were found to be few in number or absent, while in the great majority of lesions of all ages in which the exudate was composed predominantly of neutrophils, pneumococci were abundant. They believe that the mobilization of the macrophages represents an immune response of the pulmonary tissue cells.

Experimental as well as clinical investigations have shown that antibodies are found locally in very low titre only, and invariably cannot be found in the blood stream when the neutrophils are operating alone against an acute infection. When antibodies can be demonstrated locally, neutrophils have been largely replaced by monocytes and clasmatoocytes.

As early as 1906, Buxton and Torrey showed that during the early stages of transit of bacteria from the peritoneal cavity to the blood

stream, there is very little phagocytosis in the mediastinal glands or elsewhere but later an increasing number of bacteria is found within the clasmatocytes of the lymph nodes. In 1923, Gay and Marion demonstrated the difference in the protection afforded against streptococcic infections by the clasmatocytes and neutrophils. In pleural cavities prepared by beef broth when the granulation tissue contained large numbers of clasmatocytes, the animals were highly resistant to infection, while animals with acutely inflamed pleural cavities infiltrated with neutrophils died. Gay is also of the opinion that local tissue immunity develops before general immunity.

The experimental work of Mengle, which shows that in induced spreading peritonitis in dogs absorption from the peritoneal cavity is delayed in direct proportion to the severity and duration of the inflammation of Opie and Menchen which shows that the later stages of inflammation prevent diffusion of colloids and the dissemination of bacteria, of Berlin which shows that antitoxin of tetanus appeared in the fixation abscess of hyperimmunized horses on the seventh day of Vidal which

shows that following typhoid fever, agglutinins first appeared in the blood between the seventh and tenth days, of my associates and I who were unable to demonstrate antitoxin for the toxin of *Clostridium welchii* in appreciable quantities in the blood of patients recovered from spreading peritonitis due to a perforated appendix before the seventh day all seem to indicate that it takes time for immunity to develop.

The experience of surgeons together with the results of laboratory investigation shows that inflammation is a process primarily designed by nature to protect man and animal. Microscopic as well as gross tissue changes local as well as humoral antibody titration show that the essential to protection is the end result of antigen cell reaction. From the time micro organisms and neutrophils meet until local and humoral products are formed, progressive cellular or tissue changes in systematic succession occur. If uninterrupted by man there will develop, invariably, a localized collection of material, the end result of a process designed for our protection—*thus the friendly enemy*.

JOHN O BOWLER

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE eighth edition of Macleod's well known *Physiology*¹ is essentially a new book for it has been almost entirely rewritten under the editorship of Dr Philip Bard. The volume is really composed of the contributions of nine individuals, each one a specialist of note in his field. This arrangement is highly desirable for it is generally recognized that physiology covers a territory beyond the capacity of any single individual.

The subject is introduced by a description of the neuromuscular mechanism. Then follows quite naturally the chapters on excitation, muscle, nerve, reflexes and the central nervous system. An understanding of these subjects is really necessary for the succeeding chapters on special senses, circulation, respiration, metabolism, hormones, water balance and kidney function. It is interesting to note that a special section has been devoted to the distribution and regulation of water in the body.

The text contains 355 well selected illustrations. Recent advances in physiology, such as plasma clearance, pituitary relationships, humoral transmission of the nerve impulse, the chemistry of muscular contraction, cellular respiration, carbon dioxide transportation and electrophysiology are all well discussed. Technical details and discussions for advanced students are placed in small type. The bibliography is unusually complete and helpful. It is a question whether it would not be somewhat more available if it were consecutively numbered.

Macleod's *Physiology* has a threefold appeal. It is a suitable text for medical students, by virtue of its discussions and bibliography it may be regarded as somewhat of a manual for teachers, the applications of physiology which are made to medicine and surgery are of value to the student as well as the physician or surgeon who wants to keep up his physiological understanding of disease.

WALTER J. MEER

FEW research men would undertake the task which Markowitz attacked in writing this book², and it is likely that few would accomplish so successful a result. If one is critical of the book one has but to remember that it treats of a difficult subject for exposition in text form, and the author takes justifiable cover under the statement that the book is not meant to be a compendium.

The surgical procedures discussed deal practically entirely with dogs as subjects. It is true, much

elementary instruction is given, such as for animal preparation, operating room procedure, and the tying of knots. Most workers in surgical research are already familiar with these facts, but they are not out of place in this book, for with them it is also useful to medical students or other beginners in experimental surgery. The fundamental technique of many standard surgical operations is clearly described, and they are applicable in most cases to human as well as animal surgery. The section on surgery of the gastro-intestinal tract and other abdominal viscera is especially good and quite complete. Throughout the book the illustrations are simple, clear, and effectively used.

The style of the text is, in the author's word, "discursive," and this helps to keep the book alive and readable. There is an interesting short chapter concerning the antivivisection movement at the beginning of the book.

JOHN MARTIN

THE nature of *Approved Laboratory Technic*³ has not changed materially from the first edition, which was reviewed in this Journal, volume 54, page 725, April, 1932. "Each chapter has been thoroughly revised and the majority rewritten." Many new illustrations have been added. Unlike the first edition, the present edition was not prepared under the auspices of the American Society of Clinical Pathologists. Instead, a group of 28 collaborators, who are listed, have approved the technique of the methods included. Five new chapters have been added: Methods for the Hormonal Diagnosis of Early Pregnancy, Hydatiform Mole, Chorionepithelioma and Teratoma of the Testes by Dr Israel Davidsohn and Dr Harry L. Reinhart, Diagnostic Mycological Methods and Methods of Examination of the Skin and Mucous Membranes for Animal Parasites by Dr Edwin S. Gault, Methods for Conducting Tests for Allergy with the Assistance of Dr Louis Tuft, and Histological Methods and the Preparation of Museum Specimens by Dr Frank W. Konzelmann.

The book is divided, as formerly, into five sections: (1) general laboratory methods, (2) clinical pathological methods, (3) bacteriological methods, (4) serological methods, and (5) chemical methods. As the title of the book implies, only the technique of methods is covered. No attempt has been made to give indications or interpretations of laboratory tests. Various techniques are described in com-

¹ MACLEOD'S PHYSIOLOGY IN MODERN MEDICINE. Edited by Philip Bard et al. 8th ed. St. Louis: The C. V. Mosby Co., 1938.

² TEXTBOOK OF EXPERIMENTAL SURGERY. By J. Markowitz, M.B. (Tor.), Ph.D., M.S. in Exp. Surg. (Minn.) Baltimore: William Wood & Co., 1937.

³ APPROVED LABORATORY TECHNIC. CLINICAL, PATHOLOGICAL, BACTERIOLOGICAL, MYCOLOGICAL, PARASITOLOGICAL, SEROLOGICAL, BIOCHEMICAL, AND HISTOLOGICAL. By John A. Kolmer, M.D., Dr. P.H. Sc.D., LL.D., LL.D., I.A.C.P. and Fred Boerner, M.D. 2d ed. New York and London: D. Appleton Century Co., 1938.

siderable detail and instruments and steps in procedure are frequently illustrated. Such illustrations as the mixing of feces with water seem almost too simple to be included. Only occasional reference is made to the original descriptions of methods.

The chapter on animals including care inoculating bleeding and the table on blood standards in animals should prove especially useful to the laboratory worker. It is surprising that a method so universally used as the Newcomer determination of the hemoglobin does not find a place in such a work. Omission of the Tallquist and Dare methods is probably warranted.

Chiefly to recommend this book are the excellent chapters on bacteriology and serology. These subjects have seldom been so well treated in a volume on laboratory methods. Some of the new chapters will be of special value to the dermatologist and to the allergist. Because of its nature this book will probably be more useful to teachers, clinical pathologists and laboratory technicians than to general physicians and students. It can be stated without reservation that Kolmer and Boerner's *Approved Laboratory Technique* should be on the reference shelf of every chemical laboratory.

HOWARD L. ALT

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

INTERNSHIPS AND RESIDENCIES IN NEW YORK CITY 1934-1937 THEIR PLACE IN MEDICAL EDUCATION Report by the New York Committee on the Study of Hospital Internships and Residencies. Jean Alonzo Curran M.D. Executive Secretary. New York: The Commonwealth Fund. London: Oxford University Press. 1938.

DISEASES OF THE THYROID, PARATHYROID AND THYMUS By André Crotti M.D. F.A.C.S. LL.D. R.I.C.S. 3d rev. ed. Philadelphia: Lea & Febiger. 1938.

PRACTICAL CLINICAL GYNECOLOGY By Henry C. Falk M.D. F.A.C.S. New York: American Journal of Surgery Inc. 1938.

THE BIOLOGY OF ARTERIOSCLEROSIS By M. C. Wintermiz M.D. R. M. Thomas M.D. P. M. LeCompte M.D. Springfield Ill. and Baltimore Md. Charles C. Thomas. 1938.

PRACTICAL OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY By Adam Edward Schlanser M.D. Philadelphia: Lea & Febiger. 1938.

A SYNOPSIS OF THE DIAGNOSIS OF THE ACUTE SURGICAL DISEASES OF THE ABDOMEN By John A. Hardy B.Sc. M.D. F.A.C.S. St. Louis: The C. V. Mosby Co. 1938.

INJECTION TREATMENT OF VARICOSE VEINS AND HEMORRHOIDS By H. O. McPheeters M.D. F.A.C.S. and James Kerr Anderson M.D. F.A.C.S. Philadelphia: F. A. Davis Co., 1938.

LES PÉRICÉLITES By P. Dominici. Preface by Prof. G. Marion. Paris: G. Doin & Cie. 1937.

COLLECTION DES ACTUALITÉS DE MÉDECINE PRATIQUE. LES TRAITEMENTS ORTHOPÉDIQUES ET CHIRURGICAUX DES RHUMATISMES CHRONIQUES By René Simon. Paris: G. Doin & Cie. 1938.

LA TACTIQUE OPÉRATOIRE Published under the direction of M. Robinet and W. Stern. **TACTIQUE OPÉRATOIRE DES GLANDES ENDOCRINES** By G. Jeanneney and P. Foucault. Paris: G. Doin & Cie. 1938.

SURGICAL NURSING By E. L. Elhason A.B. M.D. Sc.D. F.A.C.S. L. Kraetzer Ferguson A.B. M.D. Elhabeth Keller Lewis R.N. 5th rev. ed. Philadelphia: Montreal: London: J. B. Lippincott Co. 1936.

EMERGENCY SURGERY By Hamilton Bailey F.R.C.S. (Eng.) 3d ed. Baltimore: William Wood & Co. 1938.

LE PROBLÈME DU TRAITEMENT BIOLOGIQUE DES FRACTURES (EXPLORATION EXPÉRIMENTALE) By Prof. Pankratiew B. E. Samarkand U.S.S.R. 1937.

ENDOKRINE THERAPIE IN DER GYNAEKOLOGIE. ÄTIOLOGIE UND BEHANDLUNG DES KARIKINOMS By Dr. Jules Samuels. Leiden: Holland: A. W. Sythoff's Uitgeverij. smaatshappij N.V. 1938.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

FREDERIC A. BESLEY, Waukegan, Illinois, *President*
HOWARD C. NAFFZIGER, San Francisco, *President-Elect*

New York Committee on Arrangements
HENRY W. CAVE, *Chairman*, HOWARD A. PATTERSON, *Secretary*
Brooklyn-Long Island Committee on Arrangements
DONALD E. MCKENNA, *Chairman*

PRELIMINARY PROGRAM FOR 1938 CLINICAL CONGRESS

IN the following pages there appears a preliminary schedule of operative clinics and demonstrations at the hospitals and medical schools, prepared by the Committees on Arrangements for the twenty-eighth annual Clinical Congress of the American College of Surgeons, to be held in New York and Brooklyn, October 17 to 21. It will be noted that clinics are to be held on the afternoon of Monday, October 17, and the mornings and afternoons of each of the four following days. Wednesday, October 19, has been designated as Brooklyn-Long Island day, and no clinics are scheduled for the hospitals in New York on that day. The clinical program, published in tentative form at this time, will be revised and amplified during the months preceding the Congress.

In addition to an ample and well-arranged schedule of operative clinics, at which the technique of a wide variety of surgical procedures will be demonstrated, the committees are arranging a series of non-operative clinics in many of the larger hospitals and the medical schools for the presentation of important work being done in many special fields, such as traumatic surgery, thoracic surgery, neurosurgery, plastic surgery, experimental surgery, fractures, cancer, etc. The programs are to be so correlated that the visiting surgeon may be assured of the opportunity to devote his time continuously, if he so wishes, to clinics dealing particularly with the special subjects in which he is most interested. For example, it is planned to arrange so that fracture clinics or cancer clinics will be available each forenoon and afternoon during the Congress.

The surgeons of New York, Brooklyn and Long Island, under the leadership of strong and representative committees, expect to provide a program of clinics and demonstrations that will present a complete showing of the clinical activities in all departments of surgery in that great medical center. The committees are assured of the hearty co-operation of the clinicians at the five medical schools and more than seventy hospitals that will participate in the clinical program. The committees in charge of arrangements are as follows:

NEW YORK

HENRY W. CAVE, <i>Chairman</i>	JOHN A. MCCREERY
HOWARD A. PATTERSON, <i>Secretary</i>	JOHN J. MOORHEAD
FRANK E. ADAIR	EUGENE H. POOL
FREDERIC W. BANCROFT	JAMES I. RUSSELL
FRANK E. BERRY	MORRIS K. SMITH
ROBERT E. BUCKLEY	J. BENTLEY SQUIER
RALPH COLP	BYRON STOOKEY
WILLIAM DARRACH	GEORGE GRAY WARD
CARL EGGERS	BENJAMIN P. WATSON
GEORGE J. HEUER	CARNES WEEKS
CHARLES GORDON HEYD	JOHN M. WHEELER
ROBERT H. KENNEDY	ALLEN O. WHIPPLE
SAMUEL J. KOPETSKY	PHILIP D. WILSON
	ARTHUR M. WRIGHT

BROOKLYN-LONG ISLAND

DONALD E. MCKENNA, <i>Chairman</i>	JOHN E. JENNINGS
CHARLES A. ANDERSON	A. W. MARTIN MARINO
ROBERT F. BARBER	RAYMOND B. MILES
J. WESLEY BULMER	LEO S. SCHWARTZ
CHESTER L. DAVIDSON	FEDOR L. SENGFR
AUGUSTUS HARRIS	ROBERT A. WILSON

BROOKLYN DAY

A feature of this year's Clinical Congress will be Brooklyn Day—Wednesday, October 19—plans

the Congress for many years and will continue to do so by reason of the constructive program of the College, demanded by the increasing number of traumatic patients

Friday—(1) Symposium on obstetrics and gynecology, a tentative program for which includes:

Polypus Uteri and Its Treatment by Vaginal Hysterectomy ARCHIBALD D. CAMPBELL, M D, Montreal
Experience with the Melhado Maneuver for Persistent Posterior Position GEORGE M. WHITE, M D, St John.

Ovarian Hormones and Carcinogenesis LUDWIG A. EMGE, M D, San Francisco

(Subject to be selected) JENNINGS C. LITZENBERG, M D, Minneapolis

The Management of Uterine Prolapse by Multiple Plastic Procedures EDWARD A. SCHUMANN, M D, Philadelphia

Wertheim Operation for Cancer of the Uterus Prof. PAUL WERNER, M D, Vienna

(2) Symposium on urologic infections, a tentative program for which includes:

Obstructive Uropathies ALEXANDER RANDALL, M D, Philadelphia

Tuberculosis of the Genito-Urinary Tract in Children GILBERT J. THOMAS, M D, Minneapolis

Problems in Differential Diagnosis between Urologic Lesions and Abdominal Lesions HERMAN L. KRETSCHMER, M D, Chicago

Pyelonephritis and Its Treatment WILLIAM F. BRAASCH, M D, Rochester, Minn

(3) A fracture symposium, dealing with the diagnosis and treatment of specific fractures by modern approved methods. A feature of this symposium will deal with improved facilities for graduate training in the subject of fracture treatment. The high level, from both scientific and practical viewpoints, that has been reached by the authoritative transactions of the Committee on Fractures, under whose auspices the program has been arranged, will be maintained for this session.

SYMPOSIUM ON GRADUATE TRAINING FOR SURGERY

A symposium on a subject of great interest to all fellows, "Graduate Training for Surgery and the Surgical Specialties," will be presented on Monday morning at 10 o'clock in the opening session of the annual hospital conference. The papers and discussion, participated in by leaders in the field of surgical education and in clinical practice, will have to do with the content of the courses included in the proposed plan. It is the intent of the College that no qualified man shall lack the opportunity to obtain the graduate training necessary to meet the present requirements for fellowship in the College, and hospital support is essential in making available wider graduate training opportunities.

The College has committed itself to a thorough, systematic, and determined effort to advance graduate training for surgery. It will be conceded that more opportunities for graduate training must be provided if thoroughly trained surgeons are to be supplied in sufficient numbers. During the past two years an intensive study has been made of hospitals which are at present equipped and organized to provide acceptable graduate training under the criteria for graduate training for surgery as formulated by the College, and also of other hospitals which, with some slight adjustment, can qualify under the criteria. The list of hospitals which have been approved for graduate training in surgery and the surgical specialties will be presented in this symposium.

PRE-CONVOCATION MEETING OF INITIATES

As the convocation and the presidential meeting will be combined in one session on Monday evening, a portion of the convocation ceremonies will be conducted at a formal session of the fellows of the College in the ballroom of the Waldorf-Astoria on Monday afternoon at 3 o'clock. The program for this session will include addresses dealing with the ideals, purposes and activities of the College, by Dr. Frederic A. Besley, president, Dr. George Crile, chairman of the Board of Regents, Dr. Irvin Abell, vice chairman of the board, Dr. Howard C. Naffziger, president-elect, Dr. Bowman C. Crowell and Dr. Malcolm T. MacEachern, associate directors. The reading of the fellowship pledge in unison by the initiates and the signing of the fellowship roll will be followed by a reception to the initiates and members of their families by the officers, regents, and fellows.

ROUND TABLE CONFERENCES

A series of midday round table conferences provides an innovation at this year's Congress, which, it is believed, will win immediate approval. These conferences will be held on Tuesday, Wednesday and Friday, from 12 to 1 o'clock, in rooms with capacities of from one to two hundred. Because of the expected interest in these conferences, and because of limited accommodations in certain of the rooms, admittance will be controlled by means of special tickets, issued to the visiting surgeons at the registration desk.

The following subjects and leaders of the conferences have been selected:

Infections in Surgery MONT ROGERS REID, M D, Cincinnati

Shock ALFRED BLALOCK, M D, Nashville

The Choice of Anesthetic JOHN S. LUNDY, M D, Rochester, Minn

for which are being arranged by the Brooklyn-Long Island Committee on Arrangements. A preliminary schedule of clinics for both the morning and afternoon of that day appears in the following pages. On Wednesday evening a scientific session, for which a special program is being arranged, will be held in the ballroom of the Waldorf Astoria Hotel with Dr. Donald E. McKenna, Chairman of the Brooklyn-Long Island Committee presiding. He will deliver an address of welcome on behalf of his committee and the Brooklyn-Long Island fellows.

EVENING SESSIONS

At the presidential meeting and convocation on Monday evening in the ballroom of the Waldorf Astoria, Dr. Henry W. Case, Chairman of the New York Committee on Arrangements, will deliver an address of welcome. A number of distinguished surgeons from foreign countries are expected to attend the Congress and will be introduced at this session by Dr. Frank W. Lynch of San Francisco, vice president. The presidential address by Dr. Frederic A. Besley, of Waukegan, Illinois, the retiring president, will be followed by the inauguration of the new officers. President, Howard C. Naffziger, M.D., San Francisco; first vice president, Vernon C. David, M.D., Chicago; second vice president, Fraser B. Gurd, M.D., Montreal. The 1938 class of initiates will be presented by Dr. George Crile, chairman of the Board of Regents, and fellowships conferred by the president. A feature of this evening session will be the annual oration on surgery.

Programs for the scientific sessions on Tuesday, Wednesday and Thursday evenings are being prepared by the Executive Committee of the Board of Regents. Eminent surgeons of the United States and Canada and visiting surgeons from foreign countries have been invited to present and discuss papers dealing with surgical subjects of timely importance. These programs include a symposium on the Treatment of Bronchiectasis, in which Dr. Norman S. Shennstone of Toronto will present the surgical viewpoint and Dr. J. J. Singer, of Los Angeles, the medical viewpoint. A second symposium will deal with Regional Ulcers, in which Dr. Charles G. Myrter of Boston will present the surgical viewpoint and Dr. Burtill B. Crohn, of New York, the medical viewpoint. For the annual fracture oration Dr. Isidore Cohn of New Orleans will discuss the 'Evolution of Fracture Treatment'. W. H. Ogilvie, M.D., F.R.C.S., surgeon to Guys Hospital, London, England, will read a paper on 'The Radical Operation for Cancer of the Stomach'.

In addition to an extensive schedule of operative clinics and demonstrations at the hospitals and schools, prepared by the subcommittees on ophthalmological and otolaryngological surgery, as presented in tentative form in the following pages, programs are being prepared for scientific sessions for these two sections on Tuesday and Thursday evenings at the Waldorf Astoria Hotel. Visiting ophthalmologists and otolaryngologists will present and discuss papers of special interest to those who practice these specialties.

AFTERNOON SESSIONS

Programs are in preparation for six scientific sessions to be held in the grand ballroom of the Waldorf Astoria, on Tuesday, Wednesday, Thursday and Friday afternoons, at two o'clock. The papers to be presented will deal with cancer, in industrial medicine and traumatic surgery, fractures, urology, obstetrics and gynecology.

Tuesday—A cancer symposium, confined to a discussion of the treatment of cancer of various organs for curative and palliative purposes by surgery and radiation with an evaluation of their efficacy. Among the subjects to be presented will be cancer of the lung, esophagus and breast. This symposium will be conducted under the sponsorship of the Committee on the Treatment of Malignant Diseases which has contributed so greatly to the progress of cancer treatment on this continent.

Wednesday—A symposium of 'Surgical Procedures on the Handicapped Patient'. The tentative program includes:

- Factors Determining Selection and Admission of Anesthetics: WESLEY BOURNE, M.D., Montreal.
- Surgical Procedures on the Diabetic: LELAND S. McKEITHRICK, M.D., Boston.
- Medical Aspects in Pre-operative and Postoperative Care of Diabetic and Cardiac Patients: JAMES E. PALLIN, M.D., Atlanta.

Thursday—A symposium on industrial medicine and traumatic surgery. Subjects of direct interest to surgeons in industry and to those dealing with the surgery of trauma will be presented under the auspices of the Committee on Industrial Medicine and Traumatic Surgery. Among the subjects to be discussed are: The hazards of dust in industry and their control; industrial dermatoses; treatment of direct trauma to certain parts of the body; the rehabilitation of the injured man in industry. The work of the College with the medical services in industry during the year will be reported together with a twelve year summary of the College's activities in this field. This session has furnished one of the especially attractive features of

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Shock ALFRED BLALOCK, M D, Nashville

The Choice of Anesthetic JOHN S. LUNDY, M D, Rochester, Minn

The Immediate Repair of Cutaneous Defects **SLINGER**
L. KOCH M.D. Chicago
 Craniocerebral Injuries **CLAUDE C. COLEMAN M.D.**
 Kuchinond
 The Surgical Problem of Hypertension **LOYAL DAVIS**
M.D. Chicago
 Thoracic Surgery **DANIEL C. ELLIS M.D.** Atlanta
 The Invention of Postoperative Pulmonary Complications **EMILE HOLMAN, M.D.** San Francisco
 Obstetrics **JOHN FRASER M.D.** Montreal

HOSPITAL CONFERENCE

The annual hospital conference will open the Congress with a session in the Ballroom of the Waldorf Astoria at 10 o'clock on Monday morning. At this session a complete report of the college plan for graduate training in surgery will be presented and the approved list of hospitals officially announced.

On Monday afternoon and on Tuesday Wednesday and Thursday, both morning and afternoon an interesting program of papers, round table conferences and practical demonstrations, all dealing with the many problems related to hospital efficiency, is being prepared. It is planned to make this year's session of wide interest and practical character through a careful selection of subjects to be presented and discussed by surgeons and hospital executives, particular interest being directed toward professional standards and the vital problems related to hospital economics.

HEADQUARTERS—TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Waldorf Astoria Hotel on Park Avenue between 49th and 50th Streets where the grand ballroom and large adjacent foyers, the Astor Gallery, Jade and Basilidon Rooms, all on the third floor of the hotel have been reserved for Congress headquarters—scientific sessions and conferences, and for the scientific and technical exhibits.

The technical exhibition together with the registration and clinic ticket bureaus, will be located in the east foyer Astor Gallery, Jade and Basilidon Rooms all on the third floor of the hotel. The bulletin boards on which the daily clinical program will be posted each afternoon for the following day, will be placed in these rooms. Leading manufacturers of surgical instruments, x-ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus and supplies of all kinds, pharmaceuticals and publishers of medical books will be represented in this exhibition.

RAILROAD FARES

No special rates have been authorized by the railroads for the 1938 Clinical Congress in New

York and Brooklyn so that certificates will not be required. However, the railroads in the western northwestern and southwestern states will offer for sale in October round trip tickets to New York via the Chicago and St. Louis gateways with a 30-day return limit at a low rate. In the south eastern states round trip tickets with a 15-day return limit will be available.

In the territory east of Chicago and St. Louis north of the Ohio and Potomac rivers, including the north Atlantic and New England states and the eastern provinces of Canada, regular rates of three cents per mile in pullmans and two cents per mile in coaches will be in effect.

Local ticket agents will provide more complete information as to rates, routes and stop-over privileges.

NEW YORK HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Waldorf Astoria, there are many first-class hotels within short walking distance of headquarters providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee.

	Minimum Rate to 10th Street	
	Single	Double
Ambassador Park Ave at 51st St	\$6.00	\$8.00
Barclay 111 East 45th St	6.00	10.00
Lebmont 112 Lexington Ave at 49th St	3.50	6.00
Biltmore Madison Ave at 44th St	6.00	8.00
Chatham Vanderbilt Ave at 45th St	4.00	7.00
Commodore 42nd St at Lexington Ave	3.50	5.00
Lexington Lexington Ave at 45th St	3.50	4.00
New Weston Madison Ave at 50th St	4.00	6.00
Park Lane 200 Park Ave	6.00	8.00
Ritz Carlton Madison Ave at 46th St	7.00	9.00
Possevelt Madison Ave at 45th St	5.00	7.00
Shelton Lexington Ave at 48th St	3.00	4.50
Waldorf Victoria Park Ave at 50th St	7.00	10.00

ADVANCE REGISTRATION

The hospitals and medical schools of Greater New York afford accommodation for a large number of visiting surgeons but to insure against overcrowding attendance at the Congress will be limited to a number that can be comfortably accommodated at the clinics. The limit of attendance will be based upon the result of a survey of the operating rooms and laboratories of the hospitals and medical schools to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance. A registration fee will be required of surgeons attending the annual Clinical Congress such fees providing the funds with which to meet the expenses of the

Congress To each surgeon registering in advance a formal receipt will be issued, which is to be exchanged for a general admission card upon his registration at headquarters during the Congress. This card is not transferable and must be presented in order to secure clinic tickets and admission to scientific sessions.

A resolution adopted by the Board of Regents provides that the registration fee for fellows and endorsed junior candidates shall be \$5 00, that no fee for the 1938 Congress shall be required of

initiates (class of 1938), that the fee for non-fellows attending as invited guests of the College will be \$10 00.

Admittance to clinics and demonstrations at the hospitals will be controlled by means of clinic tickets. This plan provides an efficient means for the distribution of the visiting surgeons among the various clinics and assures against overcrowding. The number of tickets issued for any clinic will be limited to the capacity of the room in which the clinic is given.

The Immediate Repair of Cutaneous Defects SUMNER
L. KOCH M.D. Chicago
Cranio-cerebral Injuries CLAUDE C. COLEMAN M.D.
Richmond
The Surgical Problem of Hypertension LOYAL DAVIS
M.D. Chicago
Thoracic Surgery DANIEL C. ELKIN M.D. Atlanta
The Prevention of Postoperative Pulmonary Complica-
tions EMILE HOLMAN M.D., San Francisco
Obstetrics JOHN FRASER M.D. Montreal

HOSPITAL CONFERENCE

The annual hospital conference will open the Congress with a session in the Ballroom of the Waldorf Astoria at 10 o'clock on Monday morning. At this session a complete report of the college plan for graduate training in surgery will be presented and the approved list of hospitals officially announced.

On Monday afternoon, and on Tuesday, Wednesday and Thursday, both morning and afternoon, an interesting program of papers, round table conferences and practical demonstrations all dealing with the many problems related to hospital efficiency, is being prepared. It is planned to make this year's session of wide interest and practical character through a careful selection of subjects to be presented and discussed by surgeons and hospital executives, particular interest being directed toward professional standards and the vital problems related to hospital economics.

HEADQUARTERS—TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Waldorf Astoria Hotel on Park Avenue between 49th and 50th Streets where the grand ballroom and large adjacent foyers, the Astor Gallery, Jade and Basildon Rooms, all on the third floor of the hotel have been reserved for Congress headquarters—scientific sessions and conferences, and for the scientific and technical exhibits.

The technical exhibition together with the registration and clinic ticket bureaus will be located in the east foyer, Astor Gallery, Jade and Basildon Rooms, all on the third floor of the hotel. The bulletin boards on which the daily clinical program will be posted each afternoon for the following day, will be placed in these rooms. Leading manufacturers of surgical instruments, x-ray apparatus, sterilizers, operating room light fixtures, dressings, hospital apparatus and supplies of all kinds, pharmaceuticals and publishers of medical books will be represented in this exhibition.

RAILROAD FARES

No special rates have been authorized by the railroads for the 1938 Clinical Congress in New

York and Brooklyn so that certificates will not be required. However, the railroads in the western, northwestern and southwestern states will offer for sale in October round trip tickets to New York via the Chicago and St. Louis gateways with a 30-day return limit at a low rate. In the southeastern states round trip tickets with a 15-day return limit will be available.

In the territory east of Chicago and St. Louis north of the Ohio and Potomac rivers, including the north Atlantic and New England states and the eastern provinces of Canada, regular rates of three cents per mile in pullmans and two cents per mile in coaches will be in effect.

Local ticket agents will provide more complete information as to rates, routes and stop-over privileges.

NEW YORK HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Waldorf Astoria, there are many first-class hotels within short walking distance of headquarters providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee:

	Single	Double
Ambassador Park Ave at 51st St	\$0.00	\$8.00
Barclay 111 East 48th St	6.00	12.00
Belmont Plaza Lexington Ave at 49th St	3.50	6.00
Biltmore Madison Ave at 44th St	6.00	8.00
Chatham Vanderbilt Ave at 48th St	4.00	7.00
Commodore 42nd St at Lexington Ave	3.50	5.00
Lexington Lexington Ave at 48th St	3.50	4.50
New Weston Madison Ave at 50th St	4.00	6.00
Park Lane 299 Park Ave	6.00	8.00
Ritz Carlton Madison Ave at 46th St	7.00	9.00
Roozevelt Madison Ave at 45th St	5.00	7.00
Shelton Lexington Ave at 48th St	3.00	4.50
Waldorf Astoria Park Ave at 50th St	7.00	10.00

ADVANCE REGISTRATION

The hospitals and medical schools of Greater New York afford accommodation for a large number of visiting surgeons, but to insure against overcrowding attendance at the Congress will be limited to a number that can be comfortably accommodated at the clinics. The limit of attendance will be based upon the result of a survey of the operating rooms and laboratories of the hospitals and medical schools to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance. A registration fee will be required of surgeons attending the annual Clinical Congress such fees providing the funds with which to meet the expenses of the

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS: GENERAL SURGERY, OBSTETRICS AND GYNECOLOGY, SURGERY OF BONES AND JOINTS, GENITO-URINARY SURGERY, FRACTURES AND TRAUMATIC SURGERY, THORACIC SURGERY, NEUROSURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, OPHTHALMOLOGY, OTOLARYNGOLOGY

NEW YORK—GENERAL SURGERY

Monday

BELLEVUE HOSPITAL

E A ROVENSTINE and staff—2 (Amphi 2) Symposium on anesthesia The anesthetic management of patients with hyperactive carotid sinus reflexes, therapeutic nerve blocks (for angina, intractable pain, etc.), demonstration of the technique for oropharyngeal insufflation of oxygen

BETH ISRAEL HOSPITAL

HARRY E ISAACS and staff—2 Operations for gall bladder disease Dry clinics Cholecystectomy without drainage, common duct obstruction, resectable liver tumors

FORDHAM HOSPITAL

E R CUNNIFFE, R E WALSH, and ALFRED G FORMAN—2. Operative and dry clinics

GOUVERNEUR HOSPITAL

R. F CARTER and R B LOBBAN—2 Diagnosis and surgical management of gall bladder disease

LENOX HILL HOSPITAL

CARL EGGERS, OTTO C PICKHARDT, DEWITT STETTEN and staffs—2 General surgical operations Dry clinics Symposium on gastric and duodenal ulcer and associated lesions, with demonstration of cases, value of test meals, x-ray diagnosis, gastroscopy, the duodenal tube and its uses, ambulatory treatment of ulcer, gastroenterostomy, result of resection for ulcer, treatment of associated lesions

HERMAN FISCHER—2 Exhibition of moulages of pathological specimens of gastro-intestinal tract

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

FRANK C YEOMANS—1 30 Proctological operations

ST LUKE'S HOSPITAL

Staff—2 Dry clinics

Tuesday

BELLEVUE HOSPITAL

ARTHUR BURDICK and staff—9 30 Operations

J A McCREERY and staff—9 30 Operations

GUILFORD DUDLEY and staff—9 30 Operations

J A McCREERY, WILLIAM HINTON, WILLIAM H BARBOUR,

GUILFORD DUDLEY, and JACOB BUCKSTEIN—2 (Amphi 1) Symposium on surgical diseases of the stomach

FLOWER-FIFTH AVENUE HOSPITAL

L R KAUFMAN—2 Operative and dry clinic

FORDHAM HOSPITAL

E R CUNNIFFE, R E WALSH, and ALFRED G FORMAN—2 Operative and dry clinics

ALEXANDER NICOLL, JAMES KENYON, and LOUIS MARTON
—2 Operative and dry clinics

GOUVERNEUR HOSPITAL

F M CONWAY—9 Diverticulitis of the colon

M BERCK—9 Diagnosis and treatment of penetrating wounds of the esophagus

JOSEPH GIRDANSKY—2 Injection treatment of hernia and varicose veins

HOSPITAL FOR JOINT DISEASES

Staff—9 General surgical and proctological operations

LENOX HILL HOSPITAL

Staff—9 Dry clinic Affections of the thyroid gland and complications basal metabolism studies in goiter, simple goiter, adenoma, adenoma with hyperthyroidism, exophthalmic goiter, treatment of complications

Dry Clinics—2

CARL EGGERS Esophageal lesions

WILLIAM H STEWART and staff. Cinefluorographic demonstration of esophageal lesions

HERBERT W MEYER Reconstruction operations for epithelioma of the face

LINCOLN HOSPITAL

KIRBY DWIGHT and staff—9 Operative and dry clinics

LUTHERAN HOSPITAL

ALFRED G FORMAN and staff—9 Operations

JOHN P BRUCKNER and staff—2 Dry clinics

JOHN P BRUCKNER Ludwig's angina

CHARLES S CASSASA Intestinal obstruction

ANGELO A ZINGARO Epiphyseal fracture

LOUIS PEROTTA Technique of spinal anesthesia and end results

MEMORIAL HOSPITAL

BRADLEY COLEY—9 Amputation of leg for osteogenic sarcoma

FRANK E ADAIR—10 Radical amputation of breast for carcinoma

METROPOLITAN HOSPITAL

J. H FOBES—9 Stomach surgery with x-ray and gastroscopy, hernia, liver, spleen, appendicitis

NEW YORK CITY HOSPITAL

FREDERIC BANCROFT and MARGARET STANLEY-BROWN—9 Symposium Thrombosis, thrombophlebitis and embolism

LYMAN W CROSSMAN and staff—9 Operations

NEW YORK HOSPITAL

GEORGE J HEUER and staff—9 Operative and dry clinics

GEORGE J HEUER Surgical treatment of hypertension

**NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL**

JOHN J McGRATH—11 Operations
VINCENT HURLEY—1 30 Proctological surgery, demonstrations on the cadaver

**NEW YORK POST-GRADUATE MEDICAL
SCHOOL AND HOSPITAL**

CARL EGGERS—9 Dry clinic Surgery of the head and neck
CHARLES G HEYD—9 Operations
EDWARD W PATTERSON—9 Operations

PRESBYTERIAN HOSPITAL

ALLEN O WHIPPLE and staff—9 Operations
BEVERLY C SMITH, DAVID C BULL, LOUIS BAUMAN, and
BYRON STOOKY—9 Symposium on vascular disturbances
of extremities
JOHN M HANFORD, ARTHUR P STOUT, CUSHMAN D HAAG-
ENSEN, MAURICE LENZ, and THEODORE P EBERHARD—
2 Symposium on therapy of tumors of head and neck

ROOSEVELT HOSPITAL

WILLIAM C WHITE and HOWARD A PATTERSON—9 Thy-
roid clinic, operative and dry
LEWIS H BOOTH, MALCOLM H MUNKITTRICK, and PAUL
M WOOD—2 Anesthesia conference

ST FRANCIS HOSPITAL

ROBERT B LOBBAN and staff—9 Gastro-intestinal opera-
tions

ST LUKE'S HOSPITAL

JOHN DOUGLAS, HENRY H M LYLE, WILLIAM F MACFEE,
EDWARD J DONOVAN, MORRIS K SMITH and staff—9
Operations

ST VINCENT'S HOSPITAL

RAYMOND P SULLIVAN, CONSTANTINE J MACGUIRE, LOUIS
F SANMAN, and CLARENCE P HOWLEY—9 Operations
JOSEPH A BRADY, BERNARD D HANNAN, and HARRY V
WALSH—9 Operations
RAYMOND P SULLIVAN, CONSTANTINE J MACGUIRE,
LOUIS F SANMAN, CLARENCE P HOWLEY—9 Operations
RAYMOND P SULLIVAN, CONSTANTINE J MACGUIRE,
LOUIS F SANMAN, and CLARENCE P HOWLEY—2
Colon clinic, follow-up and pathological demonstration
GEORGE R STUART, FRANK J MCGOWAN, and FRANCIS X
TIMONFY—2 Dry clinic and ward rounds

UNITED STATES MARINE HOSPITAL

(Stapleton, S I)

C FERGUSON and R A MEE—9 Symposium on rectal
surgery
C FERGUSON and R A MEE—2 Rectal clinic
L A PALMER—3 Hernia operations

Friday

BELLEVUE HOSPITAL

C J McGUIRE, JOHN A SUTTON, ARTHUR WRIGHT, and
DR DURANTE—9 30 (Amph 1) Symposium on gall blad-
der surgery

BETH ISRAEL HOSPITAL

PERCY KLINGENSTEIN and Staff—2 General surgical clinic,
operations Graves' disease, gastroduodenal ulcer

Dry Clinics

PERCY KLINGENSTEIN Pre-operative radiation in carci-
noma of the breast

I KROSS Obstructive lesions of the small intestine with
case presentations
SAMUEL MURSON Unusual pre-operative complications of
hernia

FORDHAM HOSPITAL

E R CUNNIFFE, R E WALSH, and ALFRED G FORMAN—2
Operative and dry clinics

FRENCH HOSPITAL

ARTHUR M WRIGHT and D A DeSANTO—9 Gall bladder
symposium

LENOX HILL HOSPITAL

Staff—10 30 Symposium on lesions of the colon, diver-
ticulitis and sigmoiditis, differential diagnosis between
carcinoma and diverticulitis and sigmoiditis, carcinoma
of the colon, carcinoma of the rectum

LINCOLN HOSPITAL

BRADLEY L COLEY and staff—9 Operative and dry
clinics

MEMORIAL HOSPITAL

HAYES E MARTIN—9 Hemilaryngectomy for carcinoma
GEORGE T PACK—9 Intrascapulo thoracic amputation for
melanoma
Staff—10 Demonstration of x-ray and radium equipment
Inspection of new Memorial Hospital

METROPOLITAN HOSPITAL

CLIFFORD HAYNER—9 Problems in serious appendix cases
CHARLES HALBERSTAM—9 Perforated ulcer of the stom-
ach
JOSEPH SILEO—11 Postoperative thrombosis and embo-
lism
LOUIS PALERMO—11 30 Burns

NEW YORK CITY HOSPITAL

ISIDOR KROSS and staff—9 Surgical clinic

NEW YORK HOSPITAL

GEORGE J HEUER and staff—9 Operative and dry clinics
FRANK GLENN Acute cholecystitis
WILLIAM F MACFEE Carcinoma of the large bowel
RALPH F BOWERS Terminal ileitis
CRANSTON W HOLMAN Pre- and postoperative studies of
gastric secretion
WILLIAM A COOPER Carcinoma of the ampulla of vater
HERBERT CONWAY Leiomyosarcoma of the stomach

**NEW YORK INFIRMARY FOR WOMEN AND
CHILDREN**

MARY L EDWARD, EMMA ARONSON, and MARGARET STAN-
LEY-BROWN—9 Operative clinic
ASTA WITTNER and SOPHIE SPITZ—9 Sterility clinic

**NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL**

HERBERT C CHASE—11 Operations.
JOHN E HAMMETT—1 30 Operations
WILLIAM M COOPER—2 30 Varicose veins

**NEW YORK POST-GRADUATE MEDICAL
SCHOOL AND HOSPITAL**

THOMAS H RUSSELL—9 Operation
CARL EGGERS—2 Operations Breast, head and neck
cases
JOHN F ERDMAN—2 Operations

WILLIAM DEW ANDRUS Splenectomy
 WILLIAM F MACFEE Surgical lesions of the mouth and jaws
 RALPH F BOWERS Results in 900 thyroidectomies
 BRONSON S RAY Organization of a follow up department
 N CHANDLER FOOT Contribution of a laboratory of surgical pathology to a surgical service

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNA HILBERT MARY L EDWARDS and FRANCES BOGATKO
 —9 Surgical follow up clinic
 ELISE L ESPERANCE—2 Tumor conference

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

FREDERICK C KELLER—10 Cadaver demonstration of surgical anatomy
 ROBERT F BRENNAN—11 Operations
 JEROME M LYNCH—130 Proctological operations
 EDWARD L KELLOGG—33 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

CARL FOGGERS—9 Breast clinic (skin and cancer unit)
 WALTER T DANNEBREITH—2 Operations
 THOMAS H RUSSELL—2 Operations

PRESBYTERIAN HOSPITAL

ALLEN O WHIPPLE and LOUIS M ROUSSELOT—9 Splenectomy
 WILLIAM B PARSONS and LAURENCE W SLOAN—9 Thyroid operations
 WALTER W PALMER WILLIAM B PARSONS LAURENCE W SLOAN BERTRAM J SANGER and ARTHUR P STOUT—10 Symposium on thyroid disease
 ALLEN O WHIPPLE WILLIAM P THOMPSON KENNETH R McALPIN R WEST LOUIS M ROUSSELOT and ROBERT H F ELLIOTT JR—2 Symposium on blood dyscrasias and splenopathies

ROOSEVELT HOSPITAL

HENRY W CAVE—2 Operation ulcerative colitis
 THOMAS T MACKIE and LAWRENCE SOPHIA—9 Dry clinic
 CONDUCT W CUTLER JR HOWARD F SHATTUCK WILLIAM H BOONE and G I MCNEE—2 Symposium Surgery of the stomach
 GRANT P PENNOPER and JULIAN M FREESTON—3 Symposium Vascular surgery

ST FRANCIS HOSPITAL

ALEXANDER NICOLL and staff—9 Gall bladder operation
 CHARLES VEJVODA and staff—9 Abdominal operations

ST LUKES HOSPITAL

JOHN DOUGLAS HENRY H M LYLE WILLIAM F MACFEE EDWARD J DONOVAN MORRIS A SMITH and staff—9 Operations
 MATHER CLEVELAND and staff—2 Operative and dry clinic

ST VINCENT'S HOSPITAL

GEORGE R STUART FRANK J MCGOWAN and FRANCIS A TIMONEY—9 Operative and dry clinics
 RAYMOND P SULLIVAN CONSTANTINE J MCGUIRE LOUIS F SANMAN and CLARENCE P HOWLEY—9 Operations
 JOSEPH A BRADY BERNARD D HANNAH and HARVEY A WALSH—2 Operative and dry clinics

UNITED STATES MARINE HOSPITAL

(Stapleton S I)

L A PALMER DR COOPER DR BRADFORD F LIBERSON
 DR KENNEDY and C R SMITH—9 Symposium on gastric surgery
 DR COOPER—9 Hernia operations
 L A PALMER—2 Operative hernia and appendicectomy
 H KELMAN and DR COOPER—2 Symposium on peripheral vascular diseases

Thursday

BELLEVUE HOSPITAL

ARTHUR WRIGHT and staff—9 30 Operations
 RODRICK GRACE ARTH R B McQUILLAN HARRY O CONNOR and RUSSELL LATERSON—9 30 (Amph 1) Symposium on diseases of the thyroid
 JENKINS BECKMAN and staff—2 (Amph 3) Symposium on surgery of children

FORDHAM HOSPITAL

ALEXANDER NICOLL, JAMES KENYON and LOUIS MARTON
 —9 Operative and dry clinics
 ALEXANDER NICOLL JAMES KENYON and LOUIS MARTON
 —2 Operative and dry clinics

COUVERNEUR HOSPITAL

M FLIAS—9 Perforated gastric and duodenal ulcer
 BORIS KOEHLER—9 Lymphogranuloma venereum

HOSPITAL FOR RUPTURED AND CRIPPLED

CARL G BRIDICK FENWICK BECKMAN and staff—9 Operations symposium on operative hernia

LENOX HILL HOSPITAL

OTTO C PICKHARDT CARL EGGERS DEWITT STETSON and staffs—9 Operations

LINCOLN HOSPITAL

EDWARD D TRESEDELL and staff—9 Operative and dry clinics

MEMORIAL HOSPITAL

CLORGE BINKLEY—9 Resection for carcinoma of rectum
 GEORGE T PACK—9 Resection for gastric carcinoma
 Staff—11 Cancer conference

METROPOLITAN HOSPITAL

LOUIS CORRYLLO and SAMUEL THOMPSON—9 Surgery in tuberculous patients
 CARL FAYON—9 Carcinoma of the rectum
 W I ECKES—10 Intestinal obstruction
 JOHN HERRLIN JR—11 Water balance pre and post operative

NEW YORK CITY HOSPITAL

P A SIVER and staff—9 Operative and dry clinic
 LESTER BLUM—9 Experimental cardiac surgery
 W C TERWILLIGER—9 Varicose veins
 ROBERT T FINDLAY—9 Surgery in the poor risk aged
 JOHN H MORRISSELL—2 Perineal surgery

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNA HILBERT MARY JENNIS and ISABEL KNOWLTON
 —9 Operative clinic
 FRANCES BOGATKO—9 Varicose vein clinic

MAURICE RASHBAUM The diagnosis and management of urinary incontinence

SEYMOUR WIMPFHEIMER Chorio-epithelioma

E. A. HOROWITZ The treatment of gonorrhea in women by systemic hyperpyrexia and simultaneous pelvic heating—an evaluation of seven and one-half years experience. Rationale of treatment, indications, technique, apparatus required, results in lower genital tract infections, in salpingitis, in gonorrhoeal arthritis, late results. The treatment of gonorrhea in women by sulfanilamide. Fever therapy combined with pelvic heating (treatment of a female patient with gonorrhea)

MOPTON VESSEL Dysgerminoma of ovary, granulosa cell tumor of ovary

HERMAN LOBBE and staff—2 Manchester operation for prolapse, vaginal hysterectomy, operation for incontinence

BELLEVUE HOSPITAL

WILLIAM E. STUDDIFORD—9 30 Gynecological operations

FRENCH HOSPITAL

FREDERICK C. HOLDEN and staff—9 Gynecological symposium

HOSPITAL FOR JOINT DISEASES

Staff—2 Gynecological operations

LENOX HILL HOSPITAL

PERCY H. WILLIAMS, ROBERT L. MCCREADY and staffs—9. Gynecological operations

LINCOLN HOSPITAL

EDWARD J. DAVIN and EDWARD T. HULL—9 Operative and dry clinics

HAROLD C. INGRAHAM—2 Acidalurate and rectal ether for obstetrical analgesia

CHARLES M. McLANE—2 Physiology of the ureter in normal pregnancy

LYING-IN HOSPITAL

Symposium on Urinary Tract Infection of Pregnancy

HENRICUS J. STANDER—2 30 Relation of pyelitis to the toxemias of pregnancy

CHARLES M. McLANE—3 00 Sequelæ of pyelitis of pregnancy

HEPBERT F. TRAUT—3 30 Pyelonephritis as a complication of pyelitis of pregnancy

HENRICUS J. STANDER—4 00 Postpartum and postoperative bladder retention and its treatment

ROBERT G. DOUGLAS—4 30. Mandelic acid, sulfanilamide therapy in the treatment of acute and chronic pyelitis

ANDREW A. MARCHETTI—5 00 The pyelitis ileus syndrome

MEMORIAL HOSPITAL

WILLIAM P. HEALY—8 Gynecological operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

MALCOLM CAMPBELL—8 30 Operations

PRESBYTERIAN HOSPITAL

BENJAMIN P. WATSON and staff—9 Operative and dry clinics

BENJAMIN P. WATSON and staff—2 Symposium on eclampsia and toxemia

ROOSEVELT HOSPITAL

HOWARD C. TAYLOR, THOMAS C. PEIGHTAL, HOWARD C. TAYLOR, JR., and WILSON E. ALSOP—9 Operations

Thursday

BELLEVUE HOSPITAL

WILLIAM E. STUDDIFORD and staff—9 30 (Amphi 2) Analysis of cases of ectopic pregnancy; treatment of placenta previa, treatment of gonorrhea in the female with sulfanilamide, toxemia of pregnancy

LINCOLN HOSPITAL

EDWARD J. DAVIN and Staff—9 Use of intravenous ergonovine at the end of the second stage of labor, results in over 500 cases

HAROLD C. INGRAHAM—2 Treatment of pelvic inflammatory disease by various modalities

ROBERT L. CRAIG—2. Treatment of pelvic inflammatory disease by acetyl-beta-methyl choline

FRANK SPIELMAN—2 Gynecological pathology, some unusual ovarian neoplasms

LUTHERAN HOSPITAL

JAMES T. PADGETT—9 Gynecological operations.

LYING-IN HOSPITAL

HENRICUS J. STANDER—2 30 Study of acute yellow atrophy

HERBERT F. TRAUT—3 00 Clinical and histological differentiation between hypertrophy and hyperplasia of the endometrium

JOHN B. PASTORE—3 30 Anemia of pregnancy

ROBERT G. DOUGLAS—4 00 Development of intrapartum infection and its relation to the time of cesarean section

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

WILHEMINA RAGLAND and associates—9 Toxemias of pregnancy, x-ray pelvimetry, care of prematures

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

LOUIS J. LADIN—8 30 Operations

PRESBYTERIAN HOSPITAL

BENJAMIN P. WATSON and staff—9 Operative and dry clinics

JAMES A. CORSCADEN—2 Symposium on radiotherapy

ROOSEVELT HOSPITAL

HOWARD C. TAYLOR, THOMAS C. PEIGHTAL, HOWARD C. TAYLOR, JR., and WILSON E. ALSOP—9 Operations

ST FRANCIS HOSPITAL

CHARLES VEJVODA and staff—9 Gynecological operations.

ST VINCENT'S HOSPITAL

WILLIAM M. FORD, WALLACE K. PUGLER, JOHN F. McGRATH, AUGUST J. RAGGI and associates—2 Operations

ANTHONY ROTTINO—2 Demonstration of gynecological pathology

Friday

FLOWER-FIFTH AVENUE HOSPITAL

HENRY SAFFORD—9 Operative and dry clinic

LENOX HILL HOSPITAL

ROBERT L. MCCREADY, PERCY H. WILLIAMS and staffs—9 Gynecological operations

LINCOLN HOSPITAL

EDWARD J. DAVIN and staff—9 Dry clinics

PRESBYTERIAN HOSPITAL

ALLEN O WHIPPLE—9 Operations Pancreas.
 ALLEN O WHIPPLE and staff—10 Dry clinic and follow up Pancreatic lesions
 DANA W ATCHLEY, JOHN SCUDDER and OCTA C LEIGH—
 2 Symposium on fluid loss and fluid balance in surgery

ROOSEVELT HOSPITAL

ALFRED STILLMAN and CONDUCT W CUTLER JR.—9 Gastro-intestinal surgery

ST FRANCIS HOSPITAL

ROBERT B LOBBAN and staff—9 Thyroid operations.

ST LUKE'S HOSPITAL

JOHN DOUGLAS HENRY H W LYLE, WILLIAM F MACFEE
 EDWARD J DONOVAN MORRIS A SMITH and staff—2
 Operative and dry clinics

ST VINCENT'S HOSPITAL

RAYMOND P SULLIVAN CONSTANTINE J MACGUTHRIE
 LOUIS F SANMAN, and CLARENCE P HOWLEY—9 Operations

Days to be Announced

BABIES HOSPITAL

EDWARD J DONOVAN, FREDERIC W SOLLEY, WILLIAM G HEELS, LOUIS M ROUSSELOT and GEORGE H HUMPHREYS Operative and dry clinics.
 EDWARD J DONOVAN Congenital duodenal obstructions.
 FREDERIC W SOLLEY Treatment of general peritonitis in children
 WILLIAM G HEELS Treatment of acute empyema
 LOUIS M ROUSSELOT Surgery of the spleen
 GEORGE H HUMPHREYS Retroperitoneal infections in children

WILLIAM BOOTH MEMORIAL HOSPITAL

JOHN ROGERS and ARTHUR MCQUILLAN Thyroid clinic
 KENNETH JOHNSON Interesting cases under the Workman's Compensation Law

HARLEM HOSPITAL

CLARENCE HOWLEY LEON GINSBURG C B CASSARA and LOUIS T WRIGHT Operative and dry clinics

KNICKERBOCKER HOSPITAL

GEORGE H SEMKEN The cancer problem
 JOHN V BOHRER C JOSEPH DELANEY and PROF A PREWITT Surgery of the stomach and gall bladder

MISERICORDIA HOSPITAL

ARTHUR S MCQUILLAN Thyroid clinic
 WILLIAM T DORAN SR Gall bladder surgery
 SAUL A RITTER Surgical pathology of tumors

ROBERT E POUND X ray diagnosis of gastric and colonic tumors

MORRISANIA CITY HOSPITAL

J LEWIS AMPSTER Surgical operations with demonstration of regional anesthesia
 GEORGE E AFFLANT Operations for repair of large hernias by fascial flaps.
 WILLIAM ALLEN Dry clinic Treatment of acute mesenteric lymphadenitis.

MOUNT SINAI HOSPITAL

RALPH COLP PERCY KLINGENSTEIN SIGMUND MAGE and JOSEPH STEINBLICK Gastric surgery operations Dry clinics Pancreatic reflux palliative subtotal gastrectomy for juxta-cardiac gastric ulcer study of failures after gastro-enterostomy
 JOHN H GARLOCK, LEON GINSBURG, WILLIAM H MENCHER and MOSES SWICK Operative clinic Colonic surgery obstructive jaundice Dry clinic Ulcerative colitis carcinoma of the esophagus.

NEW YORK CITY CANCER INSTITUTE

IRA KAPLAN and staff Symposia on the diagnosis treatment and care of cancer patients demonstrating the various types and phases of cancer treated in this institute

SYDENHAM HOSPITAL

L FRIEDMAN Operations
 M BODENREIMER Operative and dry clinics Stab and bullet wounds of the chest and abdomen
 M H FREUND Rectal operations.
 C ADLERBLUM Varicose vein injections
 L J UNGER Blood transfusion—Cinger method

VETERANS ADMINISTRATION HOSPITAL

FREDERIC W BANCROFT—9 Gastric resection for pyloric obstruction symposium on thrombosis and embolism
 ALLEN G FULLER—9 Carcinoma of the rectum second stage
 H J BAILEY E P HALL and J P DELANEY—10 Inguinal hernia repair with demonstration of sliding bladder end result cases stomach and intestinal non malignant
 B F HAYDEN CARLETON BATES JAMES EWING FRANK E ADAIR FRED STEWART and associates—2 Tumor conference
 ALLEN G FULLER Carcinoma of the stomach
 E LEVY Carcinoma of the lung
 J P PALMER Carcinoma of the lip and tongue
 W G CHRISTOPHERSEN Basal cell carcinoma and carcinoma of the rectum
 CHARLES F BLOOM Collaborated material
 R C HENDERSON Collaborated material
 DEFOREST BULLOU JR Carcinoma of the larynx
 J P DELANEY Hodgkins disease and lymphosarcoma

OBSTETRICS AND GYNECOLOGY

*Monday*BETH ISRAEL HOSPITAL
(Jewish Maternity Hospital)

SAMUEL J SCADRON and EDWIN G LANGROCK—2 Operative and dry clinics Cesarean section demonstration of forceps delivery

*Tuesday*BETH ISRAEL HOSPITAL
Dry Clinics—9

HERMAN LORBER Carcinoma of fallopian tubes carcinoma of ovary with peritoneal implants five years after operation early carcinoma of uterus.

Thursday

BELLEVUE HOSPITAL

ALEXANDER R STEVENS and staff—9 30 (Amphi 3) Symposium on urinary calculus
ALEXANDER R STEVENS and staff—2 Operations

BETH ISRAEL HOSPITAL

Staff—2 30 Operative and dry clinics
ABRAHAM HYMAN Differential diagnosis in renal and suprarenal tumors
SEYMOUR F WILHELM Diagnosis and operative treatment of male sterility

LINCOLN HOSPITAL

DAVID GEIRINGER and staff—9 Operative and dry clinics

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE KUHN—9 Dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

JOSEPH F MCCARTHY—3 30 Operations

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff—2 Symposium on tumors of the kidney

ROOSEVELT HOSPITAL

SIMON A BEISLER—2 Operations

ST. LUKE'S HOSPITAL

HENRY G BUGBEE and staff—9 Operations and demonstrations of cases

Friday

LENOX HILL HOSPITAL

Surgical and Urological Staffs—9 Symposium on affections of the urinary tract and their treatment
HERMAN FISCHER—9 Exhibition of mouldages of pathological specimens of the gastro-intestinal tract

LUTHERAN HOSPITAL

TERRY M TOWNSEND—2 Operative clinic Surgery of hypertrophied prostate

PLASTIC AND FACIOMAXILLARY SURGERY

Tuesday

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON, JR —9 Operations

Thursday

BETH ISRAEL HOSPITAL

ARTHUR BARSKY—9 Operations

LUTHERAN HOSPITAL

KEITH KAHN—2 Operations

NEW YORK CITY HOSPITAL

ALFAXANDER ZIMANY—9 Operative and dry clinic

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and staff—9 Operations

METROPOLITAN HOSPITAL

SPRAGUE CARLETON—1 30 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID GEIRINGLR—3 30 Operations

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff—2 Operations

Days to be Announced

MISERICORDIA HOSPITAL

MAXIMILIAN M NEMSER Operative and dry clinics

MORRISANIA CITY HOSPITAL

TERRY M TOWNSEND Operative clinic, prostatic obstruction
JOHN DUFF and JOHN H ROTH Dry clinic Urological malignancies

MOUNT SINAI HOSPITAL

A HYMAN, L ADELMAN, GORDEN D OPPENHEIMER, and MOSES SWICK Operations and demonstrations of cases

RIVERSIDE HOSPITAL

SIMON A BEISLER Urogenital conditions in the tuberculous

SYDENHAM HOSPITAL

R L DORMASHKIN Lesions in the female urethra, relationship of bone fractures to formation of calculi in the urinary tract, treatment of urethral calculi with rubber bags and metallic dilators
S LUBASH Operations Plastic repair of the kidney pelvis in hydronephrosis
S MALISOFF Operations Transurethral resections for vesical neck obstructions

WOMAN'S HOSPITAL

HENRY G BUGBEE and staff Genito-urinary problems in relation to gynecology and obstetrics

Friday

BELLEVUE HOSPITAL

YOLANDE HUBER—9 30 Operations
YOLANDE HUBER—2 (Amphi 1) Symposium on plastic surgery

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON, JR —2 Dry clinic and follow-up

Days to be Announced

KNICKERBOCKER HOSPITAL

CLARENCE R STRAATSMAN Operations

SYDENHAM HOSPITAL

T BLUM and staff Dry clinic
J W MALINIAC Operative and dry clinics

LUTHFRAN HOSPITAL

FRED A. KASSEBOHM—9 Emergency obstetrical operations

METROPOLITAN HOSPITAL

LEON S. LOISEAUX—9 Operative and dry clinics

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID N. BARROWS—3 30 Gynecological operations
LIVERETT M. HAWES and EDWARD H. DENNEN—10 Obstetrical problems

PRESBYTERIAN HOSPITAL

BENJAMIN P. WATSON and staff—9 Operative and dry clinics

BENJAMIN P. WATSON and staff—2 Symposium on cardiac complications

ST. FRANCIS HOSPITAL

ALEXANDER NICOLI and staff—9 Gynecological operations

ST. VINCENT'S HOSPITAL

WILLIAM M. FORD, JAMES P. HENNESSY, ALEXANDER H. SCHMITT and JOSEPH E. LAVELL—2 Operative and dry clinics

ANTHONY ROTTINO—2 Pathological demonstration

Days to be Announced

WILLIAM BOOTH MEMORIAL HOSPITAL

GEORGE KOSMAK Demonstration of service facilities surgical and obstetrical with out patient departments

WILLIAM T. KENNEDY Incontinence of urine in women

MISERICORDIA HOSPITAL

FREDERICK F. KEEF and JOSEPH A. DEVLIN Gynecological operations

FRANCIS W. SOVAK Demonstration of salpingoplastic cases

ALEXANDER H. SCHMITT Obstetrical ward rounds

F. WALTER GRAVELLE Demonstration of forceps technique

RIVERSIDE HOSPITAL

NELSON B. SACKETT Gynecological complications in advanced pulmonary tuberculosis

SYDENHAM HOSPITAL

A. M. HELLMAN and staff Dry clinic Large mesenteric tumor cornual pregnancy Kennedy hysterectomy presentation of patients and specimens skadan salpingography Operations Hysterectomy for fibroids and diseased adnexa cesarean section (low flap)

J. JARCUO and staff Operations Dry clinic Roentgenography as an aid in obstetrical diagnosis uterine pyelography—visualization of the internal genitalia by means of injection of contrast media

WOMAN'S HOSPITAL

ALBERT H. ALDRIDGE, EDWARD A. BULLARD, RALPH A. HURD, WILLIAM T. KENNEDY and staff Operative and dry clinics

GEORGE GRAY WARD Treatment of gynecological cancer including demonstration of radium therapy post radiation end results in patients genito urinary complications of cancer and radiation therapy statistical end results of treatment

HARRIET MCINTOSH Roentgenological demonstrations of therapy for gynecological cancer x ray pelvimetry visualization of genital fistulae

LEON MOTYLLOFF Demonstration of gross and microscopic specimens

GENITO URINARY SURGERY

Monday

HOSPITAL FOR JOINT DISEASES

Staff—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DANIEL A. SINCLAIR—3 30 Operations

Tuesday

FLOWER-FIFTH AVENUE HOSPITAL

SPRAGUE CARLETON—9 Demonstrations of special apparatus models and sketches of kidney surgery

MEMORIAL HOSPITAL

BENJAMIN BARRINGER—10 Suprapubic cystostomy for carcinoma

METROPOLITAN HOSPITAL

SPRAGUE CARLETON—1 30 Operative and dry clinic

NEW YORK HOSPITAL

A. RAYMOND STEVENS, OSWALD LOWSLEY and staffs—2 Operative and dry clinics

NEW YORK CITY HOSPITAL

THOMAS J. KIRWIN—2 Operative and dry clinic

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE KURVER—9 Dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

HOWARD S. JACK—2 30 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

JOSEPH A. HYAMS—9 Operative and dry clinics

PRESBYTERIAN HOSPITAL

J. BENTLEY SQUIER and staff—2 Operations

ST. VINCENT'S HOSPITAL

HERBERT MOHAN WENDELL, J. WASHBURN, THOMAS F. HOWLEY, E. CRAIG COATS and GAETANO J. MECCA—9 Operative and dry clinics

UNITED STATES MARINE HOSPITAL
(Stapleton S. I.)

C. FERGUSON, R. A. MEE and C. R. SMITH—9 Symposium on prostatic surgery
C. FERGUSON and R. A. MEE—2 Operations on the prostate

NEUROSURGERY

*Monday*NEUROLOGICAL INSTITUTE
(Columbia Medical Center)

BYRON STOOKEY and staff—2 Dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL

JOSEPH E J KING—2 30 Operations

Tuesday

BELLEVUE HOSPITAL

JOSEPH E J KING—2 Operations

Symposium on Neurological Surgery—2 (Amphi 3)

JOSEPH E J KING Demonstration of cases Brain abscess, osteomyelitis of the skull, meningioma of the middle fossa

W D WINGEBACH Demonstration of cases Brain tumor, spinal cord tumor

ABRAHAM KAPLAN Operation for meningioma of the brain (moving picture), cases of extradural and subdural hematomata

FRANK TURNER Case of subdural hygroma, ventriculography and encephalography, Munro's tidal drainage

NEUROLOGICAL INSTITUTE

(Columbia Medical Center)

BYRON STOOKEY and staff—9 Operations

BYRON STOOKEY and staff—2 Dry clinic

Thursday

MONTEFIORE HOSPITAL

IRA COHEN—2 Operations

NEUROLOGICAL INSTITUTE

(Columbia Medical Center)

BYRON STOOKEY and staff—2 Operations Symposium on brain tumors

NEW YORK HOSPITAL

GEORGE J HEUER and staff—2 Dry clinics on subjects related to surgery of the nervous system

GEORGE J HEUER Surgery of the hypophysis

BRONSON S RAY Direct radiation of brain and spinal cord tumors on the operating table

HAROLD G WOLFF Headache

JOSEPH C HINSEY Visceral pain

N CHANDLER FOOT Tumors of the peripheral nerves

Friday

NEUROLOGICAL INSTITUTE

(Columbia Medical Center)

BYRON STOOKEY and staff—9 Operations

BYRON STOOKEY and staff—2 Dry clinics

Days to be Announced

MOUNT SINAI HOSPITAL

IRA COHEN and A KAPLAN Operations

FRACTURES AND TRAUMATIC SURGERY

Monday

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R MURRAY and staff—2 Dry clinic

Tuesday

BEEKMAN STREET HOSPITAL

ROBERT H KENNEDY, JAMES H HEYL, SIGMUND MAGE, LESTER BLUM, ROBERT T FINDLAY, THOMAS M LOWRY, MYRON A SALLICK—9 Ward rounds and symposium on fracture problems

BELLEVUE HOSPITAL

J GORDON LEE, HERBERT M BERGAMINI, ROBERT WADHAMS, GEORGE A KOENIG, and KENNETH M LEWIS—9 30 (Amphi 1) Symposium on fractures

NEW YORK CITY HOSPITAL

PRESTON WADE and BOARDMAN BOSWORTH—9 Operative and dry clinic

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R MURRAY and staff—9 Operations

WILLIAM DARRACH, CLAY R MURRAY and staff—2 Follow-up clinic

Thursday

BEEKMAN STREET HOSPITAL

ROBERT H KENNEDY, SIGMUND MAGE, JAMES H HEYL,

ARTHUR H TERRY, JR, CHARLES J OPPENHEIM, ELIAS RUBIN—9 Symposium on abdominal emergencies from various clinical points of view

FLOWER-FIFTH AVENUE HOSPITAL

MILTON J WILSON—9 Operative and dry clinic

FRENCH HOSPITAL

SETH M MILLIKEN—9 Fracture symposium

LENOX HILL HOSPITAL

Surgical and orthopedic staffs—9 Fracture clinic

METROPOLITAN HOSPITAL

HANSON H BINGHAM and MILTON J WILSON—9 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL

DAVID M BOSWORTH—10 Operations

NEW YORK POST-GRADUATE MEDICAL
SCHOOL AND HOSPITAL

J J MOOREHEAD—2 Operations

H H RITTER—2 Operations

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R MURRAY and staff—9 Operations

WILLIAM DARRACH, CLAY R MURRAY and staff—2 Traction

SURGERY OF THE BONES AND JOINTS

Monday

BELLEVUE HOSPITAL

ARTHUR KRIDA—2 Operations

HOSPITAL FOR JOINT DISEASES

Staff—2 Dry clinic

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—2 Out patient clinic

Tuesday

HOSPITAL FOR JOINT DISEASES

Staff—9 Dry clinic

Staff—2 Dry clinic

HOSPITAL FOR RUPTURED AND CRIPPLED

PHILIP D WILSON and staff. Orthopedic ward rounds presentation of special problems such as paralytic foot deformities scoliosis and equalization of leg lengths
BRADLEY COLLY and DOMONICK DESANTO—2 Presentation of bone tumors

MONTEFIORE HOSPITAL

ROBERT K LIPPMANN and SETH SELIG—9 Dry clinic

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on scoliosis.

Staff— Out patient clinic

Thursday

BELLEVUE HOSPITAL

ARTHUR KRIDA and staff—2 (Amphi 2) Symposium on orthopedic surgery Intracapsular fracture of the neck of the femur bone peg operation epiphyseal fracture of the neck of the femur bone and peg operation congenital dislocation of the hip genu recurvatum operation cruciate ligament repair encircling fascial band operation for play foot and hallux valgus congenital abduction of tibia Charcot's knees fusion operation modified reconstruction of the hip for osteo-arthritis.

FLOWER-FIFTH AVENUE HOSPITAL

ANSON H BINGHAM—2 Operative and dry clinic

GOUVERNEUR HOSPITAL

WALTER LUDLOW and staff—2 Presentation of cases from orthopedic and traumatic services. Fracture of the neck of the femur conservative treatment 3 cases lumbar puncture injury of intervertebral disc slipped capital femoral epiphysis open reduction 2 cases fracture of shaft of humerus traction suspension treatment operations for weak feet head injuries with visual disturbances 2 cases head injuries new aspects of management Russell traction fractured femurs in children

HOSPITAL FOR JOINT DISEASES

Staff—9 Operations.

Staff—2 Dry clinic

HOSPITAL FOR RUPTURED AND CRIPPLED

PHILIP D WILSON and staff—2 Elbow fractures carpal injuries slipped femoral epiphyses, etc

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on tuberculosis of the joints.

Staff—2 Out patient clinic

UNITED STATES MARINE HOSPITAL

(Stapleton, S I)

W G DOKAN—2 Operations

Friday

GOUVERNEUR HOSPITAL

WALTER LUDLOW and staff—9 Presentation of cases from orthopedic and traumatic services Fractured femur with sciatic nerve injury fractures of the jaw selective neurectomy fracture of humeral condyles 6 months after open correction 2 cases fixation of oblique fractures of long bones by Kirschner wire ambulatory preadmission incidence of open correction in fresh fractures fractures of tibial plateau, club foot treated by conservative methods.

HOSPITAL FOR JOINT DISEASES

Staff—9 Operative and dry clinic.

Staff—2 Operations

HOSPITAL FOR RUPTURED AND CRIPPLED

PHILIP D WILSON and staff—2 Operations.

LINCOLN HOSPITAL

ARMITAGE WHITMAN—9 Operative and dry clinic

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Operations

Staff—2 Out patient clinic

Days to be Announced

MOUNT SINAI HOSPITAL

SETH SELIG Fixation of osteo-arthritis of the hip joint by Smith Peterson nail
ROBERT LIPPMANN Internal fixation of intracapsular fracture of the neck of the femur by the corkscrew bolt.
EDGAR M BICK Immediate results in pathological fractures.
ALBERT J SCHEIN End results of hemiphalangectomy for hallux valgus

RIVERSIDE HOSPITAL

HENRY MILCH Bone complications in advanced pulmonary tuberculosis

SYDENHAM HOSPITAL

H D SONNENSCHEN J G WISNER M M YODMAN and A A SCHIMM Dry clinic. Fractures of shoulder wrist and elbow

VETERANS ADMINISTRATION HOSPITAL

T F CARROLL—2 Demonstration of artificial limb assembly modified and improved braces fabricated jacks and supports orthopedic shoes

CHARLES F BLOOM—2 Presentation of radiological equipment x ray material films and lantern slides of current cases and others of particular interest to the general surgeon and cancer specialist.

R C HENDERSON—2 Pathological demonstration correlation of laboratory material

C R. BROOKS—2 Demonstration of physical therapy department new modalities of particular interest to the surgeon

RIVERSIDE HOSPITAL

LOUIS CARP and staff Operations Phrenemphraxis, pneumonolysis, thoracoplasty

Dry Clinics

LOUIS CARP Cold abscess of chest wall, thoracoscopy and contra-indications for pneumonolysis

ARTHUR H AUFSES Indications for thoracoplasty

JEROME M ZEIGLER The management of tuberculous empyema

DR BORIS A KORNBLITH Follow-up results in phrenemphraxis
MAX TASCHMAN Demonstrations of pneumothorax and its complications

SYDENHAM HOSPITAL

A S UNGER, M FRIEDMAN, J T TRAVERS, S FINLMAN, and D E EHRLICH Bizarre manifestations of lung tumors

OTOLARYNGOLOGY

Monday

LUTHERAN HOSPITAL

CHARLES C FRANCIS and staff—2 Operations

MONTEFIORE HOSPITAL

A A SCHWARTS—2 Dry clinic

NEW YORK HOSPITAL

ARTHUR PALMER and staff—2 Operative and dry clinics

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

Staff—2 Operations

Tuesday

BETH ISRAEL HOSPITAL

SAMUEL KOPETZKY and staff—2 Otolaryngological operations

HARLEM EYE AND EAR HOSPITAL

CLARENCE H SMITH and staff—9 Operative and dry clinic

LENOX HILL HOSPITAL

JOHN D KERNAN and staff—9 Bronchoscopic clinic
JOHN D KERNAN, GIRARD F OBERRENDER and staff—2 Operations

METROPOLITAN HOSPITAL

J A HETRICK—9 Operative and dry clinic, tonsils in children

NEW YORK CITY HOSPITAL

OTTO C RISCH and staff—2 Operative and dry clinics
HILTON H STROTHERS—2 Bronchoscopic clinic

PRESBYTERIAN HOSPITAL

JOHN D KERNAN and staff—2 Operations

ROOSEVELT HOSPITAL

C N HARPER, R C GROVES, H H STROTHERS, and DAVID JONES—2 Bronchoscopic clinic

ST FRANCIS HOSPITAL

HENRY J DILLEMUTH and staff—2 Operations and demonstration of cases

Thursday

HARLEM EYE AND EAR HOSPITAL

G B GILMORE—9 Bronchoscopic clinic

HOSPITAL FOR JOINT DISEASES

Staff—9 Dry clinics

Staff—2 Operations

LENOX HILL HOSPITAL

GIRARD F OBERRENDER and staff—9 Bronchoscopic clinic

METROPOLITAN HOSPITAL

J A HETRICK—9 Operative and dry clinic, tonsils in children

NEW YORK CITY HOSPITAL

HAROLD B JUDD—2 Operative and dry clinic

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

Staff—2 Operations

PRESBYTERIAN HOSPITAL

JOHN D KERNAN and staff—2 Bronchoscopic clinic

ROOSEVELT HOSPITAL

C N HARPER and R C GROVES—2 Dry clinic

ST LUKE'S HOSPITAL

WESLEY C BOWERS and staff—2 Operative and dry clinics

UNITED STATES MARINE HOSPITAL
(Stapleton, S I)

A J HUEY and W P GRIFFIN—10 Operations

Friday

FLOWER-FIFTH AVENUE HOSPITAL

J A W HETRICK—2 Operative and dry clinic

HARLEM EYE AND EAR HOSPITAL

WILLIAM M DUNNING—2 Submucous resection

Days to be Announced

MANHATTAN EYE, EAR AND THROAT HOSPITAL

JOHN R PAGE, ROBERT BUCKLEY, FRANCIS WHITE, DAVID JONES, ROSS FAULKNER, JAMES DWYER, JOSEPH KELLY, MARVIN JONES Operative clinics daily, 2 p m, demonstrations daily, 9 a m and 2 p m, tonsil clinic daily, 9 a m, endoscopy demonstration, Friday, 3 p m, demonstration of histology and pathology of the ear, nose and throat, daily, 3 p m Operations to be demonstrated Laryngectomy, laryngeal fissure, radical frontal, sphenoid, ethmoid and maxillary sinus, facial plastic, radical mastoid with and without skin grafts, simple mastoid, modified radical mastoid, petrous pyramid exploration, sinus and jugular; labyrinth, brain complica-

UNITED STATES MARINE HOSPITAL
(Stapleton, S I)

- DR COOPER and F LIBERSON—9 Shoulder injuries follow up clinic
L A PALMER and H FELMAN—9 Symposium on back injuries
R A MYE and H KELMAN—2 Symposium on head injuries

Friday

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

- HERBERT M BERGAMINI and EMMETT A DOOLEY—2 Dry clinic Fractures of the neck of the femur (at Reconstruction Hospital)

PRESBYTERIAN HOSPITAL

- WILLIAM DARRACH CLAY R MURRAY and staff—9 Fracture conference

SAINT VINCENT'S HOSPITAL

- CLARENCE P HOWLEY MAURICE C O SHEA PRESTON A WADE FRANCIS M CONWAY and JOHN A LAWLER—2 Fracture and tendon clinic

Days to be Announced

HARLEM HOSPITAL

- RALPH YOU'G Operative and dry clinics

KNICKERBOCKER HOSPITAL

- GEORGE A KOENIG PHILIP D ALLEN and staff Demonstrations of fracture cases traumatic surgery and x ray

MISERICORDIA HOSPITAL

- GASTON A CARLUCCI Traumatic surgery

MORRISANIA CITY HOSPITAL

- THOMAS I BRENNAN and THOMAS J O KANE Operations
J EUGENE BOSZAK and EMMETT A DOOLEY Dry clinic

THORACIC SURGERY

Monday

BELLFVUF HOSPITAL

- JAMES A MILLER, J BURNHAMBERSON A V S LAMBERT and F B BERRY—2 (Amph 1) Symposium on diseases of the chest

FLOWER-FIFTH AVENUE HOSPITAL

- SAMUEL THOMPSON—2 Operative and dry clinic

MONTEFIORE HOSPITAL

- ARTHUR H ALFSES and I KROSS—2 Operations

ST VINCENT'S HOSPITAL

- JOHN H MORRIS and DANIEL A MULVHILL— Operative and dry clinics

Tuesday

NEW YORK CITY HOSPITAL

- R L MOORE and G H HUMPHREYS—9 Operative and dry clinic

UNITED STATES MARINE HOSPITAL

(Stapleton S I)

- DR DAVIDSON—2 Operations

Thursday

BELLEVUE HOSPITAL

- A V S LAMBERT—9 30 Operation

LENOX HILL HOSPITAL

- Staff—2 Symposium on non tuberculous pulmonary sup-pururation Bronchiectasis and its complications etiology diagnosis treatment (bronchoscopic and surgical) lung abscess and its complications etiology diagnosis treatment (bronchoscopic and surgical)

NEW YORK HOSPITAL

- GEORGE J HELLER and staff—9 Operative and dry clinic
GEORGE J HELLER Surgical treatment of pulmonary sup-pururation
WILLIAM DEW ANDREWS Surgery of mediastinal tumors

- RALPH F BOWERS Acute and chronic empyema
CRANSTON W HOLMAN Scoliosis in intrathoracic disease
EDGAR MAYER Collapse therapy in pulmonary tuberculosis

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- POL N CORALLOS—2 30 Demonstrations on the cadaver

JESSEY TELJIAN HOSPITAL

- RICHARD L MOORE D W RICHARDS JR BYRON STOOKIT RO S GOLDEN and JOHN D KERNAN—2 Symposium on tumors of the lung

Friday

LENOX HILL HOSPITAL

- Staff—2 Symposium on surgical treatment of pulmonary tuberculosis Pneumothorax phrenic nerve crushes extrapleural pneumolysis indications for operative results of surgical treatment at this hospital during last 20 years extrapleural thoracoplasty tuberculous empyema tuberculous bronchi cinefluorographic demonstrations of respiration breathing in normal cases breathing in patients with pulmonary tuberculosis breathing in patients after phrenic crushing breathing in patients with pneumothorax breathing in patients after extrapleural thoracoplasty

ROOSEVELT HOSPITAL

- FRANK B HERRY—10 30 Symposium on lung surgery

Days to be Announced

HARLEM HOSPITAL

- JOSEPH B STENBLER Operative and dry clinics

MOUNT SINAI HOSPITAL

- HAROLD NEUTOF, ARTHUR S TOLDOFF and AMEL GLASS Operations
HAROLD NEUTOF COLEMAN B RABIN HERMAN HENNELL DR BURLIVER AMEL GLASS and ARTHUR S TOLDOFF Symposium on abscess of the lung Pathogenesis patho-logy clinical features roentgenological features localization operative treatment results of operation

INSTITUTE OF OPHTHALMOLOGY

(Columbia Medical Center)

JOHN M WHEELER and staff—2 Operative and dry clinics

MANHATTAN EYE, EAR AND THROAT HOSPITAL

R TOWNLEY PATON—9 Demonstration of cornea transplanting

DAVID H WEBSTER and staff—2 Operations.

ST LUKE'S HOSPITAL

GUERNSEY FREY and staff—2. Operative and dry clinics.

Days to be Announced

MORRISANIA CITY HOSPITAL

JOSEPH S HORY Operative clinic, lesions of the lens and ocular muscles

MORRIS JAFFE and FRANK LAGATTUTA Dry clinic Interesting eye conditions in relation to general medicine

MOUNT SINAI HOSPITAL

KAUFMAN SCHLIVEK and staff Cataracts, trephine, Lagrange, Safar for detachment, ptosis-advancement of levator

RIVERSIDE HOSPITAL

CLIFFORD W ELLISON Eye conditions in tuberculous patients

tions of otitic origin such as brain abscess cerebellar abscess and meningitis

FRED M LAW Demonstration of x ray films daily 2 p.m.

MORRISANIA CITY HOSPITAL

CLARENCE H SMITH Operative clinic mastoid surgery
G B GILMORE Bronchoscopic clinic Demonstration of interesting cases

MOUNT SINAI HOSPITAL

Staff Intracranial complications of otitic origin Recovered cases of streptococcus meningitis petrositis sepsis of otitic origin value of sulfanilamide in otological conditions. Histopathological studies

RUDOLPH KRAMER and staff Operative and dry clinic
JACOB L MAYBAUM WALTER L HORN SAMUEL ROSEN
JOSEPH G DRUSS HARRY ROSENWASSER and ELGENE R SNYDER Neuro-otological case

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

Staff—9 Endoscopic procedures and laryngeal surgery

PRESBYTERIAN HOSPITAL

JOHN D KERNAN and staff—2 Operations.

RIVERSIDE HOSPITAL

GEORGE D WOLF DAVID J FRANK Operations Direct laryngoscopy and cauterization of larynx Dry clinic Tuberculous laryngitis in various stages.

VETERANS ADMINISTRATION HOSPITAL

DEFOREST BALLOU Jr.—10 Operation Laryngofissure partial laryngectomy Dry clinic Carcinoma of the larynx

OPHTHALMOLOGY

Monday

HARLEM EYE AND EAR HOSPITAL

MORRIS JAFFE—2 Refraction clinic

MANHATTAN EYE EAR AND THROAT HOSPITAL

LEWIS W CRIGLER and staff—2 Operations

NEW YORK HOSPITAL

BERNARD SAMUELS and staff—2 Discussion of interesting problems in ophthalmological pathology Dry clinic Diseases of the eye

Tuesday

BELLEVUE HOSPITAL

WEBB WEEKS and staff—3 Operations for cataract glaucoma and squint

HARLEM EYE AND EAR HOSPITAL

THOMAS HAYES CURTIS—2 Interesting eye cases

INSTITUTE OF OPHTHALMOLOGY (Columbia Medical Center)

JOHN M WHEELER and staff—2 Operative and dry clinics

MANHATTAN EYE EAR AND THROAT HOSPITAL

DR MONTALVAN—9 Follow up clinic on glaucoma
H ROBERTSON SKEEL and staff—2 Operations

METROPOLITAN HOSPITAL

ARTHUR W CRAMERS—130 Operations.

MONTEFIORE HOSPITAL

SIGMUND A AGATSTON—9 Dry clinic

NEW YORK EYE AND EAR INFIRMARY

F W SHINE CLYDE F McDONALD and CONRAD BERENS—10 Operative and dry clinics
SAMUEL P OAST WEBB W WEEKS and BERNARD SAMUELS—2 Operative and dry clinics.

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinics.

UNITED STATES MARINE HOSPITAL (Stapleton SI)

R. AEBLIE and W P GRIFFY—9 Operations.

Thursday

BETH ISRAEL HOSPITAL

WEBB WEEKS—230 Ophthalmological operations.

HARLEM EYE AND EAR HOSPITAL

WILMOT B ALLEN—2 Interesting eye cases.

INSTITUTE OF OPHTHALMOLOGY (Columbia Medical Center)

JOHN M WHEELER and staff—2 Operative and dry clinics.

LENOX HILL HOSPITAL

ERNEST F KALIG JOHN J REID Jr. and staff—2 Operations.

MANHATTAN EYE EAR AND THROAT HOSPITAL

DR MONTALVAN—9 Demonstration of contact glasses
NORTON DEL FLETCHER and staff—9 Operations.

NEW YORK EYE AND EAR INFIRMARY

F W SHINE CLYDE F McDONALD and CONRAD BERENS—10 Operative and dry clinics
SAMUEL P OAST WEBB W WEEKS and BERNARD SAMUELS—2 Operative and dry clinics.

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinic

Friday

BELLEVUE HOSPITAL

WEBB WEEKS and staff—2 (Amph 2) Demonstrations of postoperative cases illustrated with results from operations for cataract glaucoma and plastic surgery of the eye and orbit

HOSPITAL FOR JOINT DISEASES

Staff—2 Dry clinic

INSTITUTE OF OPHTHALMOLOGY

(Columbia Medical Center)

JOHN M WHEELER and staff—2. Operative and dry clinics

MANHATTAN EYE, EAR AND THROAT
HOSPITAL

R. TOWNLEY PATON—9 Demonstration of cornea transplanting

DAVID H WEBSTER and staff—2 Operations

ST LUKE'S HOSPITAL

GUERNSEY FREY and staff—2. Operative and dry clinics.

Days to be Announced

MORRISANIA CITY HOSPITAL

JOSEPH S HORY Operative clinic, lesions of the lens and ocular muscles

MORRIS JAFFE and FRANK LAGATTUTA Dry clinic Interesting eye conditions in relation to general medicine

MOUNT SINAI HOSPITAL

KAUFMAN SCHLIVEK and staff Cataracts, trephine, La-grange, Safar for detachment, ptosis-advancement of levator

RIVERSIDE HOSPITAL

CLIFFORD W ELLISON Eye conditions in tuberculous patients

tions of otitic origin such as brain abscess cerebellar abscess and meningitis

FRED M LAW Demonstration of x ray films daily 2 p m

MORRISANIA CITY HOSPITAL

CLARENCE H SMITH Operative clinic mastoid surgery
G B GILMORE Bronchoscopic clinic Demonstration of interesting cases

MOUNT SINAI HOSPITAL

Staff Intracranial complications of otitic origin Recover cases of streptococcus meningitis petrositis sepsis of otitic origin value of sulfanilamide in otological conditions Histopathological studies
RUDOLPH KRAMER and staff Operative and dry clinic
JACOB L MAYBAUM WALTER I HORN SAMUEL ROSEN
JOSEPH G DRUSS HARRY ROSENWASSER, and EUGENE R SNYDER Neuro-otological case

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

Staff—9 Endoscopic procedures and laryngeal surgery

PRESBYTERIAN HOSPITAL

JOHN D KERNAN and staff—2 Operations

RIVERSIDE HOSPITAL

GEORGE D WOLF DAVID I FRANK Operations Direct laryngoscopy and cauterization of larynx Dry clinic Tuberculous laryngitis in various stages

VETERANS ADMINISTRATION HOSPITAL

DEFORREST BALLOU Jr—10 Operation Laryngofissure partial laryngectomy Dry clinic Carcinoma of the larynx

OPHTHALMOLOGY

Monday

HARLEM EYE AND EAR HOSPITAL

MORRIS JAFFE—2 Refraction clinic

MANHATTAN EYE EAR AND THROAT HOSPITAL

LEWIS W CRIGLER and staff—2 Operations.

NEW YORK HOSPITAL

BERNARD SAMUELS and staff—2 Discussion of interesting problems in ophthalmological pathology Dry clinic Diseases of the eye

Tuesday

BELLEVUE HOSPITAL

WEBB WEEKS and staff—2 Operations for cataract glaucoma and squint

HARLEM EYE AND EAR HOSPITAL

THOMAS HAYES CURTIN—2 Interesting eye cases

INSTITUTE OF OPHTHALMOLOGY (Columbia Medical Center)

JOHN M WHEELER and staff—2 Operative and dry clinics

MANHATTAN EYE EAR AND THROAT HOSPITAL

DR MONTALVAN—9 Follow up clinic on glaucoma
H ROBERTSON SKEEL and staff—2 Operations

METROPOLITAN HOSPITAL

ARTHUR W CHAMBERS—1 30 Operations

MONTEFIORE HOSPITAL

SIGMUND A AGATSTON—9 Dry clinic

NEW YORK EYE AND EAR INFIRMARY

F W SHINE CLYDE E McDANVALD and CONRAD BERENS—10 Operative and dry clinics.
SAMUEL P OAST WEBB W WEEKS and BERNARD SAMUELS—2 Operative and dry clinics

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinics

UNITED STATES MARINE HOSPITAL (Stapleton SI)

R. AERLIE and W P GRIFFEY—9 Operations

Thursday

BETH ISRAEL HOSPITAL

WEBB WEEKS—2 30 Ophthalmological operations.

HARLEM EYE AND EAR HOSPITAL

WILMOT B ALLEN—2 Interesting eye cases.

INSTITUTE OF OPHTHALMOLOGY (Columbia Medical Center)

JOHN M WHEELER and staff—2 Operative and dry clinics

LENOX HILL HOSPITAL

ERNEST F KRUG JOHN J REID JR and staff—2 Operations

MANHATTAN EYE EAR AND THROAT HOSPITAL

DR MONTALVAN—9 Demonstration of contact glasses
NORTON DEL FLETCHER and staff—9 Operations.

NEW YORK EYE AND EAR INFIRMARY

F W SHINE CLYDE E McDANVALD and CONRAD BERENS—10 Operative and dry clinics
SAMUEL P OAST WEBB W WEEKS and BERNARD SAMUELS—2 Operative and dry clinics

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinic

Friday

BELLEVUE HOSPITAL

WEBB WEEKS and staff—2 (Amph 2) Demonstrations of postoperative cases illustrated with results from operations for cataract glaucoma and plastic surgery of the eye and orbit

HOSPITAL FOR JOINT DISEASES

Staff—2 Dry clinic

JOSEPH RAPHAEL—9 Operations Fracture clinic, demonstration in ward
 NICHOLAS H RYAN—9 Statistical study of ruptured gastric ulcer
 OTICAR TENOPYR—9 Discussion of B Welchii infection
 ROBERT BARBER—9 Operations
 EDWARD P DUNN—9 Operations
 CHARLES B JONES—9 Operations
 E JEFFERSON BROWDER—2 Neurosurgical clinic
 WALTER A COAKLEY—2 Operations Cleft palate, tube graft for contracted scar, nasoplastic
 EDWIN J GRACE—2 Thoracoplastic operations, pectoral transplant for coronary occlusion (Beck)

LONG ISLAND COLLEGE HOSPITAL

EMIL GOETSCH Operative and postoperative reactions in hyperthyroidism
 RALPH HARLOE Operation Empyema, closed treatment of all types
 S POTTER BARTLEY Fractures of the foot, clinical and economic aspect, demonstration and lantern slides
 ROBERT F BARBER Case and specimen presentation of malignant tumors of peripheral nerves
 T JEFFERSON BROWDER Neurosurgical demonstrations

LUTHERAN HOSPITAL

VINCENT BARBER and staff—9 Operations
 A V P FARDELMANN and staff—10 Operations

MARY IMMACULATE HOSPITAL

LOUIS F LICHT Thyroid surgery
 FRANK N DEALY Gastro-intestinal surgery

METHODIST EPISCOPAL HOSPITAL

HAROLD K BELL, HENRY F GRAHAM, PIERRE A RENAUD, SEYMOUR G CLARK and staff—9 Operations 2 Dry clinics

MIDWOOD HOSPITAL

BURT D HARRINGTON Operations
 WALTER A COAKLEY Plastic surgery.

NORWEGIAN HOSPITAL

DAVID LIVINGSTONE and ROBERT W TATE Operations

CARSON C PECK MEMORIAL HOSPITAL

CHARLES COCHRANE and STANLEY D BANKS—9 Surgery of large bowel
 HERBERT T WIKLE—9 Demonstration of gastric resection, lantern slides and patients
 MERRILL N FOOTE and ALISON VOSSELER—2 Thyroid surgery, dry clinic, motion pictures and slides

PROSPECT HEIGHTS HOSPITAL

W L HEEVE Discussion of wound closure
 A CAPUTI Anesthesia Cyclopropane, endotracheal, demonstration

QUEENS GENERAL HOSPITAL

F N DEALY, J S THOMAS and staff—9 Operations, general surgery
 A S W TOUROFF and L R DAVIDSON—9 Operations, thoracic surgery
 W J HOFFMAN and staff—2 Tumor clinic

ROCKAWAY BEACH HOSPITAL

CHESTER L DAVIDSON Operations

ST CATHERINE'S HOSPITAL

JOSEPH L PFEIFFER—10 Review of acute appendicitis
 DANIEL A MCATEER—10 Review of gall bladder disease

ST GILES HOSPITAL

CHARLES D NAPIER Dry clinic Vertebral epiphysitis
 FRANK B RING and JOSEPH GIANQUINTO Dry clinic

ST JOHN'S HOSPITAL

JOHN E JENNINGS and staff—9 Thoracic surgery
 STANLEY B THOMAS, GEORGE R MARSH and staff—9 Gastro-intestinal operations
 S LLOYD FISHER, GEORGE B REITZ and staff—9 Female pelvic surgery, thyroid clinic
 G FRANK SAMMIS and staff—9 Plastic surgery
 LOWELL B ECKERSON—2 Dry clinic
 CARL H GREEN—2 Dry clinic Gastro-intestinal surgery
 CHARLES E HAMILTON—2 Thoracic surgery
 PAUL L PARRISH—2 Dry clinic Pediatric surgery
 JOHN C KNAPP and staff—2 Radiology
 LEONID WATTER and staff—2 Anesthetic procedures
 KENNETH C STRONG and staff—2 Pathology
 FREDERICK J MAISEL—2 Surgical photography
 HELEN N THIRLWALL—2 Follow-up service of surgical patients

ST MARY'S HOSPITAL

WILLIAM PASCUAL, THOMAS M BRENNAN, PETER DULLIGAN and staff Operative and dry clinics
 SANFORD SHUMWAY Selected fracture problems
 DANIEL WELSH Acute intestinal obstruction due to gall stone occlusion
 HUGH MURPHY Mecholyl iontophoresis in the treatment of thrombophlebitis
 PETER DULLIGAN The management of acute intussusception
 THOMAS BRENNAN Cases illustrative of retroperitoneal hemorrhage and other types of abdominal trauma
 WILLIAM PASCUAL Atypical appendicitis, difficulties in recognition and management
 JOSEPH RIZZO Appendicitis in pregnancy
 HUGH MURPHY and V TESORIERO Vascular clinic, demonstration of cases and methods of treatment
 JOHN SHIELDS and staff Proctological clinic
 GEORGE PRICE and WILLIAM MOITRIER, JR Demonstration of skin tumors
 WILLIAM MOITRIER, JR Ovarian tumors in their relationship to sex
 FRANCIS CURRIN Exhibits of roentgenology department
 PAUL RAFA Cholangiography in biliary tract disease.
 FRANCIS CURRIN Radiation in postoperative paratit

ST PETER'S HOSPITAL

L M RYAN Demonstrations Carcinoma of hepatic flexure, operation and therapy, recovery, carcinoma of sigmoid, operation and therapy, recovery, obstruction of common bile duct following cholecystectomy, operation and cure
 T M BRENNAN Operative and dry clinic

SOUTHSIDE HOSPITAL

BENJAMIN L FEUERSTEIN Cancer symposium Treatment of cancer in the small hospital

U S NAVAL HOSPITAL

Staff—10 Operations Hernia, femoral, colostomy

BROOKLYN—LONG ISLAND—WEDNESDAY

GENERAL SURGERY

BAY RIDGE HOSPITAL

EMIL SALCHELLI Resection of intestine
 FRANCIS J CERAVOLO Cholecystectomy
 M WILLIAM ROSS Hernia clinic
 CLIFTON L DANCE Hysterectomy
 JOHN R FLETCHER Dry clinic Perforating lesions large and small intestine
 JOHN H GREENER Dry clinic Obstructive lesions of the colon diagnosed by radiology
 MARGARET A BAKER Dry clinic Chronic mastitis prognosis and treatment medical and surgical

BETH EL HOSPITAL

HAROLD RABINOWITZ and BENJAMIN KOGUT Operative and dry clinic

BETH MOSES HOSPITAL

HARRY RABINOWITZ and HARRY FELDMAN Gastrectomy for peptic ulcer colectomy for carcinoma thyroidectomy my proctologic clinics operative and dry
 I E SIRIS One stage Miles resection for carcinoma of rectosigmoid subtotal gastrectomy for carcinoma of stomach
 HENRY S FISCHER Operative and dry clinic endocrine tumors pathological conference

BROOKLYN CANCER INSTITUTE

Operations—9

I SIRIS One-stage Miles resection for carcinoma of rectosigmoid
 J MCGOLDRICK Carcinoma of the cervix
 J J GAINY and GEORGE REITZ Radical mastectomy two cases

Dry Clinics—9

G ROBILLARD Carcinoma of large bowel
 H CHARACHE Neurogenic sarcoma 18 cases with statistical study and lantern slides
 W E HOWES Pre operative radiation of breast exhibit of bronchial carcinoma and review of six autopsied cases
 M MYERSON and J SCHMIDT Carcinoma of the larynx presentation of operated and radiated cases wax models demonstration
 H RASI Oral surgery wax model exhibit
 M N FOOTE Diagnosis and management of thyroid malignancy
 J H BLISS Malignancy of colon operative technique
 S WOLFE Carcinoma of the vulva case presentations
 H TEPPERSON Giant cell tumor radiation of lower end of femur cure presentation of patient pathology and x rays

BROOKLYN HOSPITAL

E K TANNER and staff—9 Operations
 Staff—2 Operative and dry clinics

CALLEDONIAN HOSPITAL

JOSEPH TENOPYR JOHN BRINKMAN D A McATEER and GEORGE G DIXON Operations
 JOSEPH TENOPYR W E HOWES W W HALL and staff Tumor clinic

CONEY ISLAND HOSPITAL

DANIEL A McATEER J EARL MILES JOHN HAMMETT (LORE E WEBB PHILIP GOLDSTEIN and staff—9 Operations
 DANIEL A McATEER—9 Chemistry and physiology of the biliary system
 EMANUEL MENDLISON—9 Roentgenology unusual gastro-intestinal x ray examinations.
 Staff—2 Symposium of general physical therapy procedures.

CUMBERLAND HOSPITAL

MERRILL A FOOTE and staff—9 Operations Gastric resection thyroidectomy cholecystectomy Use of stainless steel wire in abdominal closures.
 JOHN TIMM and staff—9 Operations
 HERBERT T WIKLE and staff—9 Operations Bone dust hernioplasty gastric resection
 HARRY MARTZ—2 Dry clinic Analysis of fifty consecutive ruptured gastric ulcers (lantern slides)
 JOHN GUYNE and staff—2 Dry clinic Partial gastrectomy five year report obstructive lesions of the jejunum
 J ROMANSKY—2 Dry clinic Familial neurotrophic osseous atrophy

FLUSHING HOSPITAL

JOSEPH S THOMAS JOSEPH N WICKHAM WILLIAM K ROGERS J DEKAISNES COMBES and C NELSON BAKER—9 Operations

GREENPOINT HOSPITAL

JOSEPH S BALDWIN A L SORESI J SMITH PETER J DULLIGAN and staff—9 Resection of stomach for carcinoma cholecystectomy
 JOSEPH S BALDWIN A L SORESI J SMITH PETER J DULLIGAN and staff—2 Dry clinics Burns newer advances in treatment and results for carcinoma of colon ten years peripheral vascular diseases and results and demonstration of clinic varicose vein clinic demonstration of methods Pathological demonstration of surgical specimens ward rounds

HOSPITAL OF THE HOLY FAMILY

JAMES DOWNEY EDWIN HOWE FISKE JOSEPH BALDWIN and staffs Operative and dry clinics

JEWISH HOSPITAL

LOUIS BERGER—9 Gastro intestinal diseases
 BENJAMIN BERNSTEIN and staff—9 Medical and surgical problems
 HENRY LOURIA and staff—9 Thyroid clinic
 LEO M DAVIDOFF and staff—2 Neurosurgery
 M LEDERER and H C GRAYZEL—2 Pathological demonstration
 ALEX S WEINER—2 Blood transfusions

KINGS COUNTY HOSPITAL

HECTOR W BENOIT—9 Operations Thyroid clinic demonstration in ward

GENITO-URINARY SURGERY

BETH-EL HOSPITAL

CHARLES E PANOFF Operative and dry clinic

BETH MOSES HOSPITAL

BERNARD DAVIDSON Infected renal cyst, tumor in hour-glass bladder, calculous pyonephrosis in congenital solitary kidney, renal agenesis; neuromuscular dysfunction of the ureterovesical orifices and internal vesical orifice, spontaneous regression of kidney tumor, toothpick in kidney

BROOKLYN HOSPITAL

N P RATHBUN and staff—9 Operations

CALEDONIAN HOSPITAL

GEORGE HORTON and FRANKLIN FARROW Operations

CONEY ISLAND HOSPITAL

J STURDIVANT READ—2 Operations, symposium on prostatitis

GREENPOINT HOSPITAL

Staff—9 Operations Transurethral resection 2 Dry clinic Unusual kidney cases in children

JEWISH HOSPITAL

PAUL W ASCHNER and staff—9 Operative and dry clinics

KINGS COUNTY HOSPITAL

CHARLES S COCHRANE—2 Operations and ward walks
FEDOR L SENGEL—2 Operations Plastic surgery on kidney, pelvis and ureter

LONG ISLAND COLLEGE HOSPITAL

FEDOR SENGEL Ureteral transplant, operative and dry clinic
GEORGE HORTON Nephrectomy

LUTHERAN HOSPITAL

HEINRICH WEHRBEIN and staff—2 Operative and dry clinics.

MARY IMMACULATE HOSPITAL

ELIAS RUBIN—Operative and dry clinics

METHODIST EPISCOPAL HOSPITAL

HOWARD T LANGWORTHY and ROSARIO MULE—9 Operations 2 Exhibits and discussions

PROSPECT HEIGHTS HOSPITAL

R E KINLOCH Presentation of specimens Nephrolithiasis; hydronephrosis, suppurative pyelonephritis, bilateral double kidney and double ureters, tuberculosis of the kidney, peri-arteritis nodosa, advanced hydro-nephrosis

QUEENS GENERAL HOSPITAL

F G RILEY, B DERRAH and staff—2 Operative and dry clinics

ST CATHERINE'S HOSPITAL

JOHN GRIFFIN—10 Transurethral prostatectomy

ST JOHN'S HOSPITAL

AUGUSTUS HARRIS and staff—9 Operations

ST MARY'S HOSPITAL

ANDREW J MCGOWAN, FRANK C HAMM and staffs Operative and dry clinics Pediatric urology, transurethral prostatectomy

WYCKOFF HEIGHTS HOSPITAL

LEO DREXLER Urethral calculus

FRACTURES AND TRAUMATIC SURGERY

CONEY ISLAND HOSPITAL

DANIEL McATEER and staff—2 Symposium, ward walk
PHILIP GOLDSTEIN—2 Fractures of neck of femur
GEORGE WEBB—2 Local anesthesia in acute fractures
JOHN HAMMETT—2 Fractures of surgical neck of humerus
J EARL MILES—2 Fractures of elbow joint, pinning of chip fractures

CUMBERLAND HOSPITAL

GEORGE REITZ—2 Dry clinic Transportation of head injuries, burns, fractures of bones of foot, astragalus and os calcis
LEO FASKE—2 Dry clinic Trimalleolar fracture, pathology and treatment
JOSEPH I ANTON—2 Dry clinic Madelung's deformity, value in diagnosis of dislocation at wrist (differential diagnosis), intra-abdominal injury due to blunt force
JULIUS SADER—2 Dry clinic Statistics of injuries to pedestrians and passengers in automobile accidents
FUAD SHATARA and staff—2 Dry clinic, traumatic surgery

GREENPOINT HOSPITAL

HERBERT C FETT and staff—0 Demonstration of continuous fracture service, ward rounds 2 Dry clinic

Fractures of forearm in children, Colles fractures, fractures of femur in children, shoulder fractures
NATHAN A GOLDSTEIN and staff—2 Rehabilitation clinic

KINGS COUNTY HOSPITAL

WILLIAM M ENNIS—9 Open reduction of fractures
JOSEPH TENOPYR—9 Demonstration of fractures in ward

MARY IMMACULATE HOSPITAL

JOHN M SCANNELL Operative and dry clinic

ST JOHN'S HOSPITAL

JAMES L COBB, LOUIS A THUNG and staff—9 Operations
GEORGE B REITZ—2 Dry clinic Traumatic surgery, motion picture demonstration

SOUTHSIDE HOSPITAL (Bay Shore)

ARCHIE M BAKER, GUSTAV AXHOLM, and THOMAS WINSTON Symposium

WYCKOFF HEIGHTS HOSPITAL

JOHN L KRAUSS—9 Dry clinic.

WYCKOFF HEIGHTS HOSPITAL

JOHN L. BAUER—9 Operations
 ALBERT G. COOK—9 Diverticulitis
 RUSSELL S. FOWLER—9 Gall bladder
 JOHN HORVITZ—9 Resection of stomach
 ARTHUR C. HOLTMAN—9 Nephrectomy

WILLIAM H. COOK—9 Operations
 CHARLES J. FELLG—9 Compensation surgery
 JACK SPERLING—9 Appendicitis
 Staff—2 Symposia dry clinics ward walks, exhibits of interesting pathological specimens and unusual x ray plates

OBSTETRICS AND GYNECOLOGY

BETH EL HOSPITAL

ABRAHAM KOPLOWITZ PHILIP OGINZ and HARRIS M. RABINOWITZ Operative and dry clinic

BROOKLYN HOSPITAL

W. S. SMITH and staff—9 Operations

CALEDONIAN HOSPITAL

HARVEY B. MATTHEWS M. C. DER BRUCKE and A. S. MCGREGOR Operations

CONY ISLAND HOSPITAL

HARVEY B. MATTHEWS and staff—9 Operative and dry clinics ward walks

FLUSHING HOSPITAL

GEORGE J. LAWRENCE SAMUEL L. MITCHELL and FREDERICK CARPENTER—10 Operations

GREENPOINT HOSPITAL

THURSTON WELTON FRANCIS B. DOYLE and staff—9 Operations Low cesarean transverse incision Manchester Fothergill for uterine prolapse in aged local anesthesia 2 Dry clinic Organization and operation of prenatal and gynecological clinic

HOSPITAL OF THE HOLY FAMILY

HENRY GOUBEAUD JOSEPH MCGOLDRICK WINIFRED EGAN and staffs Operative and dry clinics

JEWISH HOSPITAL

S. G. BLUM and G. KORNFELD—9 Operative and dry clinics
 LEO S. SCHWARTZ S. SCHENCK and E. V. LITTAUER—2 Operative and dry clinics

KINGS COUNTY HOSPITAL

CHARLES W. MUELLER—9 Operations
 JOSEPH L. MCGOLDRICK—9 Operation Hysterectomy
 HENRY J. GOUBEAUD JR.—9 Demonstration of still fetal study of placenta previa in ward
 CHARLES A. CORDON—9 Operations
 MORRIS GLASS—9 Ward demonstration Cardiac conditions in pregnancy toxemia in pregnancy
 RALPH GARLICK—9 Plastic for prolapse

LONG ISLAND COLLEGE HOSPITAL

ALFRED C. BECK Cesarean section
 WILLIAM A. JEWETT Fothergill operation
 HARVEY B. MATTHEWS Vaginal plastic under local anesthesia
 GEORGE W. PHELAN Tumors of the round ligament
 MERVYN V. ARMSTRONG Episiotomy and repair under local anesthesia
 SAMUEL A. WOLFF Demonstration of ovarian tumors

LUTHERAN HOSPITAL

HENRY EICHACKER and E. MAY—10 Dry clinic and ward walks

MARY IMMACULATE HOSPITAL

JAMES P. McMANUS Obstetrical surgery

METHODIST EPISCOPAL HOSPITAL

O. PAUL HEMPSTONE RALPH M. BEACH and staff—9 Operations 2 Endocrine clinic

MIDWOOD HOSPITAL

JOSEPH LEO L. MCGOLDRICK and CAMERON DUNCAN Gynecological operations

PROSPECT HEIGHTS HOSPITAL

H. T. BLAIR Presentation of specimens Krukenberg tumor ovary bilateral malignant cyst adenoma bilateral ovary fibroid of uterus with pregnancy and retroplacental hematoma ovarian cysts

QUEENS GENERAL HOSPITAL

H. P. MEYER E. A. FLEMING and staff—9 Gynecological operative and dry clinics

ROCKAWAY BEACH HOSPITAL

ALSTEN JOHNSON Gynecological operations

ST CATHERINE'S HOSPITAL

CHARLES A. GORDON—10 Genital prolapse

ST JOHN'S HOSPITAL

ALFRED W. WHITE CAMERON DUNCAN CHARLES W. MUELLER and GLEN R. MACLACHLAN—9 Obstetrical operations

ST MARY'S HOSPITAL

E. A. KEYS H. GOUBEAUD C. LOUGHERAN R. WILSON and staffs—9 Operations Vaginal hysterectomy (local), anterior and posterior colporrhaphy (local) panhysterectomy (spinal) laparotomy for ovarian cyst

H. GOUBEAUD and staff—9 Dry clinics Forceps application (manikin) Kjelland Pieper axis traction resuscitation of new born cadaver and motion pictures, graphs and charts of dehydration mortality morbidity cesarean sections report sections six x rays in placenta previa blood bank

M. MURPHY Eight cesarean sections ectopic pregnancy two cases of abdominal hemorrhage tubal in origin not ectopic

F. MITCHELL Double pregnancy double uterus abortion at fourth month one uterus full term cesarean section living baby second uterus

CHARLES H. LOUGHAN Hydatiform mole cesarean section at term living baby

J. MASTROTA Antepartum diagnosis triple pregnancy with x ray

H. JOYCE Electric cervix advantages and disadvantages

M. ABENE Hydatiform mole analysis of nineteen cases

ST PETER'S HOSPITAL

J. L. MCGOLDRICK Obstetrical review five-year period

WYCKOFF HEIGHTS HOSPITAL

WILLIAM F. BOZENHARDT Vaginal plastics
 RUDOLPH F. HERRIMAN Cesarean section

GENITO-URINARY SURGERY

BETH-EL HOSPITAL

CHARLES E. PANOFF Operative and dry clinic

BETH MOSES HOSPITAL

BERNARD DAVIDSON Infected renal cyst, tumor in hour-glass bladder, calculous pyonephrosis in congenital solitary kidney, renal agenesis, neuromuscular dysfunction of the ureterovesical orifices and internal vesical orifice, spontaneous regression of kidney tumor, toothpick in kidney

BROOKLYN HOSPITAL

N. P. RATHBUN and staff—9 Operations

CALEDONIAN HOSPITAL

GEORGE HORTON and FRANKLIN FARROW Operations

CONEY ISLAND HOSPITAL

J. STURDIVANT READ—2 Operations, symposium on prostatitis

GREENPOINT HOSPITAL

Staff—9 Operations Transurethral resection 2 Dry clinic Unusual kidney cases in children

JEWISH HOSPITAL

PAUL W. ASCHNER and staff—9 Operative and dry clinics

KINGS COUNTY HOSPITAL

CHARLES S. COCHRANE—2 Operations and ward walks
FEDOR L. SINGER—2 Operations Plastic surgery on kidney, pelvis and ureter

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GEORGE HORTON Nephrectomy

LUTHERAN HOSPITAL

HEINRICH WEHRBEIN and staff—2 Operative and dry clinics

MARY IMMACULATE HOSPITAL

ELIAS RUBIN—Operative and dry clinics

METHODIST EPISCOPAL HOSPITAL

HOWARD T. LANGWORTHY and ROSARIO MULE—9 Operations 2 Exhibits and discussions

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JOHN GRIFFIN—10 Transurethral prostatectomy

ST JOHN'S HOSPITAL

AUGUSTUS HARRIS and staff—9 Operations

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WYCKOFF HEIGHTS HOSPITAL

LEO DREXLER Urethral calculus

FRACTURES AND TRAUMATIC SURGERY

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JOSEPH TENOPYR—9 Demonstration of fractures in ward

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JOHN M. SCANNELL Operative and dry clinic

ST JOHN'S HOSPITAL

JAMES L. COBB, LOUIS A. THUNG and staff—9 Operations
GEORGE B. REITZ—2 Dry clinic Traumatic surgery, motion picture demonstration

SOUTHSIDE HOSPITAL (Bay Shore)

ARCHIE M. BAKER, GUSTAV AXHOLM, and THOMAS WINTON Symposium

WYCKOFF HEIGHTS HOSPITAL

JOHN L. KRAUSS—9 Dry clinic.

WYCKOFF HEIGHTS HOSPITAL

JOHN L. BAUER—9 Operations
ALBERT G. COOK—9 Divericulitis
RUSSELL S. FOWLER—9 Gall bladder
JOHN HORN—9 Resection of stomach
ARTHUR C. HOLZMAN—9 Nephrectomy

WILLIAM H. COOK—9 Operations
CHARLES J. FELL—9 Compensation surgery
JACK SPERLING—9 Appendicitis
Staff—2 Symposia dry clinics ward walks exhibits of interesting pathological specimens and unusual x-ray plates

OBSTETRICS AND GYNECOLOGY

BETH EL HOSPITAL

ABRAHAM FOPLOWITZ PHILIP OLIN and HARRIS M. RABINOWITZ Operative and dry clinic

BROOKLYN HOSPITAL

W. S. SMITH and staff—9 Operations

CALCEDONIAN HOSPITAL

HARVEY B. MATTHEWS M. G. DER BRUCKE and A. S. MCGREGOR Operations

CONNY ISLAND HOSPITAL

HARVEY B. MATTHEWS and staff—9 Operative and dry clinics ward walks

FLUSHING HOSPITAL

GEORGE J. LAWRENCE SAMUEL I. MITCHELL and FREDERICK CARPENTER—10 Operations

GREENPOINT HOSPITAL

THURSTON WELTON FRANCIS B. DOYLE and staff—9 Operations Low cesarean transverse incision Manchester Fothergill for uterine prolapse in aged local anesthesia 2 Dry clinic Organization and operation of prenatal and gynecological clinic

HOSPITAL OF THE HOLY FAMILY

HENRY GORSEAUD JOSEPH MCGOLDRICK WILLIAM E. LAM and staffs Operative and dry clinics

JEWISH HOSPITAL

S. G. BILM and G. FORNFIELD—9 Operative and dry clinics
LEO S. SCHWARTZ S. SCHENK and I. V. LITTAUER—2 Operative and dry clinics

KINGS COUNTY HOSPITAL

CHARLES W. MUELLER—2 Operations
JOSEPH L. MCGOLDRICK—9 Operation Hysterectomy
HENRY J. GOLDBAUER—9 Demonstration of statistical study of placenta previa in ward
CHARLES A. GORDON—9 Operations
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RALPH GARLICK—9 Plastic for prolapse

LONG ISLAND COLLEGE HOSPITAL

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WILLIAM A. JEWETT Fothergill operation
HARVEY B. MATTHEWS Vaginal plastic under local anesthesia
GEORGE W. FRIEDMAN Tumors of the round ligament
MERYON V. ARMSTRONG Episiotomy and repair under local anesthesia
SAMUEL A. WOLFE Detorsion of ovarian tumors

LUTHERAN HOSPITAL

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MARY IMMACULATE HOSPITAL

JAMES P. McMAHON Obstetrical surgery

METHODIST EPISCOPAL HOSPITAL

O. PAUL HUMPHSTONE RALPH M. BEACH and staff—9 Operations 2 Endocrine clinic

MIDWOOD HOSPITAL

JOSEPH LEO I. MCGOLDRICK and CAMERON DUNCAN Gynecological operations

PROSPECT HILLS HOSPITAL

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ROCKAWAY BEACH HOSPITAL

ALSTON JOHNSON Gynecological operations

ST. CATHERINE'S HOSPITAL

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ST. JOHN'S HOSPITAL

ALFRED W. WHITE CAMERON DUNCAN CHARLES W. MUELLER and CLARENCE R. MACLACHLAN—9 Obstetrical operations

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JOSEPH R L'EPISCOPO Bone block operation for painful hips

HERBERT C FETT Report of experience in arthrotomy of the knee joint

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HENRY C COURTEN Operative and dry clinics

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CHARLES L STONE CHARLES A ANDERSON and staff—2 Operations

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SURGERY

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ASPHYXIA NEONATORUM

The Pivot Upon Which Turns the Movement to Prevent Asphyxial Death

PALUEL J. FLAGG, M D , New York, New York

OUT of a simplified method for endotracheal anesthesia, developed and described in 1927 (5), there was evolved a year and a half later, a technique for artificial respiration of the newborn. This method, described in the *Journal of the American Medical Association* (6), consisting of suction, laryngoscopy, intubation, and insufflation of oxygen and carbon dioxide under controlled pressure, was little more than an extension of the method, advocated by Meltzer in 1909 and later by Chevalier Jackson in 1913. The reviewer's contribution consisted merely in the development of simplified instrumentation for precision treatment.

The instruments—laryngoscope, insufflation tube, and pressure manometers—were designed to meet emergency use in general hospital service. All perishable parts have been eliminated and as far as possible, the equipment has been made indestructible. The armamentarium was offered as a means of carrying out, with the least possible hazard, accepted surgical principles, as they might be applied in the treatment of asphyxia of the newborn.

These principles may be stated briefly as.
Exposure of the field (laryngoscopy under direct vision)

Removal of foreign material (suction of fluid and the relief of the obstruction)

Application of treatment, directly to the damaged area with the greatest possible precision, dispatch and absence of trauma (intubation by direct vision and insufflation of oxygen carbon dioxide under controlled pressure)

Compared with the prevailing method of blind catheterization, oral suction of pharynx and esophagus (rarely trachea), followed by the manual application of an inhaler to the face of the baby, in the expectation that the gas therein will find its way past the obstruction offered by relaxed tongue, soft palate, faucial pillars, epiglottis and arytenoids, to the trachea, the method proposed proved to be all that could be desired.

By the use of the technique described the airway is easily visualized. Fluid in the field is removed under direct vision. The infant glottis is readily brought into view. The condition of the cords is noted. A lubricated metal tube of suitable size with a velvet eye is introduced without trauma, the glottic chunk above the tube indicates ample space and the absence of glottic pressure. Suction of the upper trachea is easily accomplished; oxygen introduced under a pressure of 25 millimeters mercury for periods of 3 to 5 seconds promptly clears the anoxemia present.

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Painting by S. Thomas Lawrence F.R.A.

Engraving by Sam. Al. Cousin

Sir Astley Paston Cooper

1768-1841

be eliminated, oxygen brought into direct contact with the bronchial and alveolar capillaries, permitting thereby support and stimulation of the depressed respiratory center without undue trauma, provides material for a basic routine. The selection of such equipment should be based upon the degree with which it fulfills these needs. Additional claims and improvements need not be ignored but should be regarded as material for investigation and research.

Judgment passed upon equipment by the surgeon has been shown to be incomplete if limited to theoretical appraisal. The hand, the eye, and the ear of the judge must all function if the impression of a mechanical problem is to be complete. This point was impressed upon the author some years ago. An eminent authority in the field of asphyxia, entirely familiar with the theoretical aspect of the special problems involved, showed but little interest in a proposed solution. One day, however, having been induced to carry out the suggested procedures himself, he promptly adopted these as practical, personal accomplishments, entirely satisfying and readily available to others.

Routine practice in resuscitation should be carried out upon the cadaver. There is no mutilation or postmortem sign of instrumentation which interferes with subsequent autopsy findings. There is no excuse when intubation is practiced to demonstrate this upon live babies without specific pathological indications. Babies to be treated for the relief of atelectasis should be placed in the hands of the most experienced operators. Students and the newly initiated should not be permitted to practice such instrumentation.

The confirmation of a sound routine turns upon trained observation, a conviction that these observations are important and valuable, and a careful record which will bring to light the actual morbidity and mortality occurring in the relief of a given pathology.

ANATOMICAL CONSIDERATIONS

The head of a newborn baby of an average weight of 6 to 8 pounds, (2700 to 3600 grams) is about the size of a small grapefruit and weighs approximately as much. It is attached

to the body by a relatively long, relatively thin neck which in the state of complete relaxation gives no support to the head. The normal baby's mouth will readily admit one finger, occasionally two. The pharynx in relaxation will admit the tip of the finger up to the attachment of the epiglottis. The distance from the gums to the glottis is about 3 inches, a relatively short distance. The distance between the epiglottis and the glottis is often so short that when the lip of the laryngoscope is placed against the epiglottis (1), it impinges against the glottis itself and obscures it. The glottic opening varies from 3 to 5 millimeters in vertical diameter and transversely at the posterior commissure is from 2 to 3 millimeters. In complete relaxation, the soft parts of the airway are collapsed and as soft and adherent as the finger of a rubber glove or a collapsed toy balloon. While insufflation tends to open these passages, suction immediately causes them to collapse still farther, simulating the phenomenon seen when one attempts to use a soft rubber tube on a suction instrument. The trachea is about 3 inches from the glottis to the bifurcation. The tracheal rings are soft and easily compressible but they maintain the lumen of the trachea under ordinary conditions. The chest wall with its intercostal muscles, accessory muscles, and the diaphragm, offer little resistance to interpulmonary gas pressure when the lungs are inflatable. When antenatal atelectasis exists, however, the resistance to expansion offered by the chest wall interferes seriously with mechanical efforts to distend alveoli by mechanical insufflation. Incidentally, this suggests pulmonary tissue resistance to pressure, entirely different from that offered by the open chest. It is, therefore, impractical to attempt to measure the fragility of the lung tissue to endotracheal pressure when the visceral pleura is not protected by the resistance of the chest wall. A pressure of 25 millimeters of mercury which may cause rupture of the alveoli in a lung removed from the chest, seldom if ever, produces evidence of trauma when applied to the lung protected by the chest wall, when the pressure so applied does not extend over a period of 5 seconds.

When the respiration is completely in abeyance upon the beginning of the treatment, its return is often ushered in by very rapid, very shallow efforts which may be heard taking place through the insufflation tube. When the airway is not completely free of all obstruction, the minimal returning respiratory efforts are not observed until their cumulative effect becomes apparent in a strong effort which breaks through the prevailing obstruction. This accumulative effort seen as the initial gasp and said to precede regular respiratory efforts may not take place if the vigor of the respiratory center has been reduced by anoxemia.

To claim that such an initial respiration, either spontaneous or induced by drugs, such as alpha lobelin (15) for instance, is the natural precursor of normal respiratory effort, that it serves to clear the airway for future respiratory efforts, or that it overcomes atelectasis in any very special manner, that indeed it is anything but an evidence of existing respiratory embarrassment, is highly improbable.

When a technique is acquired and developed as the means of relieving certain definite difficulties such as respiratory obstruction, anoxemia, central depression, the road pursued and the landmarks observed along the way are forgotten by the traveler in the satisfaction which he enjoys in arriving at his objective. He is inclined to discredit the difficulties of his approach and to stress only results. The writer admits this experience. He has been inclined to overlook the essential details of technique impressed upon him through the obligation to provide safety in the development of equipment. Having completed these safeguards, he proceeded to ignore the reason for their existence and the obligation incumbent upon him to make these reasons clear to the uninitiated.

After an interval of 10 years, during which time students have become instructors, and since the method herein referred to has become common practice, in fact, sometimes too common to deserve note (12) it appears timely to review the use and the abuse of the technique as it has come to the attention of the reviewer.

VIEWPOINT OF THE SURGICAL DIRECTOR

The surgeon who directs resuscitation without the advice and co operation of a competent pneumatologist (3, 4, 7, 8, 16, 17, 18, 19) faces a twofold problem—administration and research. To avoid confusion and to yield results, these problems must be sharply defined and segregated. Marshal Foch's query, "What is it exactly that you wish to do?" may well be borne in mind. The first implies the correct functioning of an accepted routine directed to a clear cut objective and based upon sound principles of pathological physiology. The second problem, research, is distinctly contributory. Its purpose is to provide improvements in routine when these improvements have been recommended by sound theory and practice.

To disregard these principles is to invite confusion and to delay real progress. A brief reflection will bring to light the frequency with which these objectives and their sequences are disregarded. The surgeon, oppressed by many demands upon his time and attention, turns the problems of routine and research to an assistant or to a technician. The latter, impatient of routine impressed by the novelty of unsupported claims, and keen for revolutionary and mechanized technique is an easy prey to the high powered commercial approach well equipped with argument and impressive by virtue of convenient gadgets calculated to overcome all difficulties. Without the protection of a sound foundation provided by a knowledge of physiological requirements, the satisfaction of which suggest simplicity and directness of approach, there is nothing to prevent an endless procession of new equipment much of which may actually violate basic principles in treatment. A recent communication by Vandell Henderson brings the prevalence of this situation to a focus.

BASIC PROBLEMS OF RESUSCITATION

Experience suggests that the basic problems of resuscitation are as follows: respiratory obstruction, anoxemia, and central respiratory depression.

Any technique or armamentarium by means of which respiratory obstruction may

turning voluntary respiration without in any way interfering with it by attempting to supplant an artificial rate and rhythm. The operator attempts, as it were, to feed the returning respiration with the oxygen which it requires to resuscitate the respiratory center.

If, however, there is no respiratory effort whatever, one is justified in attempting to initiate such effort by stimulating the Hering-Beuer reflex by the use of maximum pressure (25 mm. hg.) Following this initial stimulation, the technique described may be followed to advantage.

The return of normal vigorous respiration will be accompanied by muscular movement of the extremities and movement of the muscles of the face. The baby's head will begin to move from side to side. After normal respiration through the tracheal tube is permitted for a short period, the tube may be removed, whereupon the baby will begin to cry.

Prolonged postoperative treatment of the newborn due to drug depression or other causes when the respiration has been demonstrated to be free, is best accomplished by means of an oxygen chamber suited to the baby's size and equipped with the necessary heating and ventilating devices.

In passing, it is interesting to note that a definite diagnosis of congenital cardiac lesions or gross lesions of the circulatory system may be diagnosed by the baby's reaction to endotracheal insufflation of oxygen. The cyanotic baby is insufflated and intubated in the usual manner. If the color remains constantly dusky or fails to clear completely in the presence of endotracheal oxygen upon pressure, a portion of the circulation leaving the right heart is finding its way directly into the arterial system. We see this in a patent foramen ovale and in a congenital shortcircuiting of the large blood vessels. The reason for this phenomenon is that a definite portion of the circulating blood has failed to pass through the lungs and is contaminating the oxygenated stream. Neonatal atelectasis, cerebral trauma, as well as persistent thymus and even the rare, tracheo-esophageal fistula, fails to give this unique reaction. In each case, adequate oxygen insufflation temporarily, but completely, clears the color of the circulating

blood. A tracheo-esophageal fistula may be suspected when there is a persistent long continuing discharge of fluid or froth through the glottis following satisfactory initial intubation, suction, and an apparently clear respiratory tree.

Fluid within the pulmonary airway may be expected in cesarean sections and in breech deliveries if the compression action of the uterus upon the flexed chest has not functioned to squeeze out fluid contained therein. It is, therefore, desirable to practice immediate oral, pharyngeal, and, if relaxation permits, endotracheal suction of babies delivered by these two procedures.

Operators have experienced difficulty in exposing the glottis of premature babies, insisting that the blade of the laryngoscope provided was too wide for the undersized pharynx. The author has met this situation by keeping the lip of the laryngoscope well anterior to the epiglottis, thus exposing the epiglottis and glottis simultaneously. By this technique he has used the laryngoscope for demonstration in a premature infant cadaver weighing $1\frac{1}{2}$ pounds, whose head was not much larger than a lemon and whose glottis was so tiny that it was intubated by means of a nurse's hair pin.

If the infant to be resuscitated is premature, it is practical to use the tube employed for suction as an insufflation instrument. This tube is considerably smaller in diameter than is the ordinary endotracheal insufflation tube. With this technique, the suction tube is introduced into the small glottis, and suction is gently performed. The tube is then withdrawn and is attached to the insufflation tube, the mucus is blown out, and the tube is replaced as an insufflation tube.

ARMAMENTARIUM

Laryngoscope. Inasmuch as the mouth and the pharynx of the ordinary newborn will admit a finger, a laryngoscope blade limited in size to such a transverse diameter provides no embarrassment. The lamp attached is relatively large and has a long life. The length of the laryngoscope blade is such that when it is introduced to its full depth the operator's fingers, grasping the handle, contact the

PHYSIOLOGICAL PATHOLOGY

A newborn baby presents one of two extremes of reflex activity and muscle tone. It is extremely important to recognize these variations as they form the criteria of treatment. There is no excuse to attempt to intubate a newborn baby whose head is moving about from the action of the muscles of the neck, or whose gums close upon the gloved finger of the operator. Asphyxia produces progressive relaxation and loss of the reflexes of the airway. In extreme asphyxia the gums separate without resistance, the tongue is completely relaxed, the soft palate and the pillars of the fauces are perfectly flaccid, the epiglottis drops into view, the glottis appears beneath the lip of the laryngoscope with cords which are silent and which are separated or in contact with one another. The mucous membranes of the field are cyanotic and injected to a degree which varies directly with the vigor of the baby's circulation. A vigorous circulation gives rise to the well known asphyxia livida, a depressed circulation on the other hand results in the so called asphyxia pallida.

Between the two extremes of active reflexes and muscle tone on the one hand, and complete disappearance of the reflexes and complete relaxation on the other, appears every variation. These variations depend upon the viability of the baby.

It is, therefore, practical and reasonable to make an immediate prognosis of the baby's condition by the state of the reflexes and muscle tone found upon the initial examination. If a baby permits the introduction of the finger into the mouth without resistance, exposure of the pharynx by the laryngoscope is indicated and will be entirely non traumatic. If upon laryngoscopy, there is found to be active swallowing reflexes and spasm of the glottis, it will be unnecessary to intubate, for the viability present indicates that central activity will promptly result in a respiratory effort. The act of opening the mouth, lifting the tongue out of the field, and removing detritus in the airway provides adequate immediate treatment for the baby.

On the other hand if laryngoscopy reveals the pharyngeal reflex to be in abeyance and

the cords inactive, the indications are to introduce a suction tube between them to practice endotracheal suction, and to follow this by re intubation and insufflation of oxygen carbon dioxide. In the presence of an active circulation, cyanosis which may be present upon intubation and which is seen as lividity in the mucous membranes, ecchymosis of the skin or cyanosis of the extremities, will promptly disappear upon insufflation of oxygen. Cyanosis will be replaced by a pink color, the reflexes which are in abeyance will reappear, in accordance with the degree of viability present.

In asphyxia due to obstetrical manipulations without cerebral hemorrhage, or in respiratory obstruction from fluid in the airway, the reflexes return very promptly. However, if the asphyxia is the result of prolonged anesthesia or of medication to the mother, a longer period will elapse before the reflexes return. A vigorous circulation will promptly pick up oxygen available in the trachea and in the bronchi. A depressed circulation will react more slowly. Care must be exercised, therefore, in providing surface heat as an initial circulatory stimulation.

The rhythm of respiration is the result of a highly complex biochemical reaction which is complicated by asphyxial factors. It will vary in accordance with the freedom with which each individual respiratory effort takes place. If the airway is absolutely unobstructed as is the case when the endotracheal insufflation tube is in place returning respiratory effort will be noted as an extremely shallow, but regular, effort occurring as rapidly or more rapidly than the pulse rate. As the vigor of the respiratory effort increases the depth of each respiration will increase and the rate will be diminished. If the respiration is obstructed these initial efforts will be obscured until the summation results in a forceful gasp, a final effort to overcome existing obstruction. When it is realized that adequate oxygenation of the circulation may readily be carried on for hours by means of endotracheal oxygen without any respiratory efforts whatsoever, the effort to establish an artificial respiratory rate and rhythm will be of secondary importance. The objective in every case is to support the re-

home and emergency use. He has repeatedly resuscitated patients, threatened by fatal asphyxia, with this simple equipment attaching to it the oxygen carbon dioxide tank available in the operating room. If labor is expected to take place in the home, the gas companies will deliver such a tank, thus reducing the surgeon's armamentarium to a small package.

MORBIDITY AND MORTALITY

The author has been struck by the tolerance exhibited by the infant larynx to instrumentation. He has had frequent opportunities to check at postmortem examination, the condition of the trachea and the vocal cords of babies who have been repeatedly intubated and who have died from cardiac or other lesions. While this resistance and tolerance is striking, it provides no excuse for hasty or rough manipulation. An inspection of the tiny, fragile structures making up the baby's airway impresses one immediately with the need of thoughtful care and of deliberate gentle manipulation. Looked upon from a statistical point of view, it is surprising to find the absence of morbidity and trauma even in the hands of the casual, partially instructed operator. The article by Dr McGrath and Dr Kuder, brings out this fact in a striking manner. The new edition of Williams' *Obstetrics*, edited by Dr Stander, and a later article by Marchetti, confirm this early impression.

The use of intubation in conjunction with negative pressure cabinet treatment, so called *iron lung*, is an important factor in the early care of these patients.

ATELECTASIS

The problem of antenatal and postnatal atelectasis is wide open for investigation. We have found to our disappointment that many babies insufflated come to autopsy showing extensive antenatal atelectasis. These lungs when removed from the chest and insufflated with a very low pressure of gas, promptly become distended and fully aerated. It would appear that the resistance offered by the chest walls and the diaphragm to the parietal surface of the infant lung in some way pre-

vents the brief insufflation employed from finding its way into the smaller air vesicles. In accordance with advice received from Dr Chevalier Jackson it is the author's practice to limit the insufflation period to 5 seconds. Since this pressure must be transmitted through a system of tubes of decreasing diameter, the resistance offered thereby becomes so great that by the time the finer radicals are penetrated, all pressure has disappeared. It has been stated that the initiation of the respiration by intravenous stimulation (15) is followed by relief of atelectasis. This claim is not accompanied by the only evidence of proof available, namely, comparative fluoroscopy and roentgenography before and after treatment, combined with volumetric mensuration of the respiratory tidal capacity. It is possible that much light on the problem of atelectasis might be brought to bear if a series of normal babies might be subjected to fluoroscopic and roentgenographic examination immediately upon birth. Insufflation of oxygen under measured pressure, performed under fluoroscopic control, recorded by roentgen-ray, would enable one to see the illumination of the atelectasis as it occurs and measure its extent.

Full term, normal babies may be subjected to examination with the laryngoscope, without trauma several days after birth, and insufflated with oxygen under measured pressure for the relief of persistent cyanosis. In the insertion of the tube under these conditions, one must be familiar with the field—an accomplishment which may be achieved without great difficulty. A number of babies, so insufflated, appear to have been relieved of cyanosis and atelectasis (1). We are not satisfied, however, with the consistency of these results.

THEORETICAL CONSIDERATIONS AND RESEARCH

The work of Rosenfeld and Snyder in which the intra-uterine respiratory movements of the rabbit fetus were observed is extremely interesting and suggestive. In the light of the reviewer's experience with the character of the newly established respiration of the newborn through an absolutely patent airway, the following hypothesis, part of which is suggested by Eastman's excellent article, invites

baby's chin With this contact and the contact of the baby's head lying flat upon the table, control of the field is practical We do not practice extension of the head over a pillow, or over the edge of the table—first, because we find this unnecessary, second, because we lose control of the head, and finally, because such a procedure produces an undue extension of the neck because of the weight of the dependent head In small babies, the laryngoscope lip remains anterior to the epiglottis, both epiglottis and glottis are brought into view simultaneously Laryngoscopy is performed upon all babies whose relaxation is such as to permit the gums to be separated without resistance

Suction While suction by the operator's mouth through a catheter may be practiced with satisfaction, the double obligation of supplying the suction and directing this to an exact location is disconcerting It is much more satisfactory to provide some source of steam, electric, or other form of suction The tube provided for oral pharyngeal suction has a curve which fits the pharynx and terminates in a velvet tip The degree of the suction applied should be regulated to meet the needs Suction should not be allowed to remain in one spot, as continuous suction of the mucous membranes results in trauma

Pharyngeal and hypopharyngeal suction should be practiced by the sterile assistant by means of a sterile suction tube immediately upon delivery of the head When delivery has been accomplished this preliminary suction should be completed as a routine toilet under direct vision Provided the baby offers no resistance, endotracheal suction should be performed with a special tube having a blunt tip the diameter of which is smaller than the glottis Endotracheal suction should be gentle and intermittent A cough reflex which may be stirred up by the endotracheal tube is helpful in expelling bronchial mucus into the trachea, where it can be removed We have practiced lubrication of the suction and the insufflation tube, in spite of the theoretical objection that a fat droplet might find its way into the smaller bronchi and cause a temporary block The possible trauma inflicted by a dry tube introduced into the

glottis is, we believe, more likely to be followed by ill effects than is the use of lubrication

Insufflation tube The measurements of the insufflation tube were secured from the cadaver The tube is L shaped The shorter leg of the L connects to the rubber tubing leading to the oxygen and carbon dioxide Near the bend of the L is a vent, by the opening and closing of which insufflated oxygen may be allowed to escape or to enter the lungs The longer leg of the L is designed so that when it is fully introduced, the angle will impinge upon the lower gum and prevent intubation at too great a depth This endotracheal element terminates in a shoulder about an inch and a half from the tip This shoulder serves as a guard against excessive depth of intubation, the tip resting, when fully intubated, half the distance between the glottis and the bifurcation of the trachea The tip is of heavy gauge metal bevelled, permitting of a velvet edge The lumen however, is sufficient to serve as a respiratory channel, through which the baby's voluntary respiration may take place When this tube is introduced a space above it and the anterior commissure of the glottis (the upper angle) are visible Gas pressure through the tube is regulated by a water manometer, in the case of the hospital equipment and by a weight, in the ambulance assembly The water manometer is much more sensitive and indicates, in addition to the maximum pressure, variations between the minimum and the maximum, and the volume of gas delivered When no gas is flowing the strength of inspiratory efforts may be measured by closing the obturation valve during inspiration The assembled equipment consists of indestructible elements with the exception of the lamp bulb and the rubber tubing which leads to the gas supply The operator will, therefore, find the mechanism available for use even after long periods of idleness provided the lamp and the gas supply is occasionally checked by the operating room nurse The author has found the portable assembly (identical with the hospital model except that the gas stand is eliminated and the water manometer replaced by a weight manometer) entirely satisfactory for

Hotel Biltmore, New York City (14) This conference, complicated by a printer's strike and synchronizing with the blizzard of February of that year, once more drew a notable assembly of speakers, including J J Walsh, H H Forbes, P N Coryllos, H B Williams, C H Watson, Charles Norris, H W Neale, H P Martland, A O Gettler, W C Phillips, Colonel C R Reynolds, D P Murphy, P A Harper, J D Kernan, R R Sayers, H H Globus, Major Leon A Fox, L H Bauer, E W Brown, M H Foster, C G Heyd, W P Northrup, Jr, Mr. Robert P MacFadden, Mr L T White, and Colonel F L Devereux Later in the spring, a symposium on asphyxia took place at the annual meeting of the Medical Society of the State of New York At this meeting, the idea of integrating anesthesia, resuscitation, and oxygen therapy as gas therapy was proposed by the speakers, Drs Jackson, Barach, and Flagg

The aims and purposes of the Society for the Prevention of Asphyxial Death were approved by the Medical Society of New York State on May 14, 1934, and by the house of delegates of the American Medical Association on June 12 of the same year

In the spring of 1935, the society was invited to co-operate with the City in June This exhibit set up by C I. Jackson and Harrison Martland finally materialized as a full section of fourteen booths demonstrating many of the more prominent forms of asphyxiation In this exhibit, that on asphyxia neonatorum prepared by the obstetrical department of the New York Lying-In Hospital enjoyed a prominent place In the Spring of 1936, upon a motion from the delegate of New York State Medical Society, the appointment of a committee on asphyxia of the American Medical Association was authorized On October 6 of the same year, the committee was named and held its first meeting in Chicago in December of that year The report of this committee appears in the *Journal of the American Medical Association* for May 1, 1937, p 1531 The report of the committee suggests the following specific causes of the generic problem of asphyxia

1 Asphyxia neonatorum

2 Asphyxia from gases, used industrially (a)

carbon monoxide from illuminating gas and from engine exhaust, (b) refrigerants such as ammonia, carbon dioxide, and dry ice, (c) fumes in the manufacture of chemicals, (d) gases associated with the oil industry, (e) gases in the mining industry, (f) fumigation for disease, the destruction of rodents on board ship and elsewhere

3 Asphyxia from gases in warfare

4 Asphyxia from drugs, hypnotics, narcotics, and sedatives, including acute alcoholism

5 Asphyxia from disease, such as acute pulmonary conditions, asthma, and cardiac decompensation

6 Asphyxia from developmental and mechanical abnormalities, such as neonatal atelectasis and collapse of the lung

7 Asphyxia from anesthesia due to overdosage, idiosyncrasy or a failure to meet mechanical obstruction, occurring in relaxation

8 Asphyxia from drowning (submersion)

9 Asphyxia from flying at high altitudes

10 Asphyxia from fire fighting (smoke, chemical poisoning)

11 Asphyxia from obstruction by foreign bodies (a) material caught in the esophagus or inhaled, (b) tumors or infections within or without the airway

12 Asphyxia from strangulation

13 Asphyxia from electrocution

14 Asphyxia from allergy

15 Asphyxia from terminal poliomyelitis

This brief résumé of the evolution of asphyxia neonatorum serves to indicate the importance which may be attached to the prevention of asphyxia in this field Asphyxia in the newborn according to the figures now available suggests that more than 60 per cent of all asphyxial deaths may be attributed to this cause Asphyxia neonatorum presents the unique distinction of occurring under ideal conditions for treatment Preparation to care for the asphyxiated patient may be completed and the patient may receive treatment immediately upon delivery There is no long interval between the accident and the treatment as in the case of submersion, carbon monoxide poisoning, and other asphyxia accidents For this reason the importance of establishing generally accepted principles covering the routine treatment of asphyxia neonatorum can scarcely be overestimated This treatment radiates through the entire field of asphyxial treatment

CONCLUSIONS

The physician who treats asphyxia neonatorum should acquaint himself with the

consideration as a logical transition from intra uterine to extra uterine life without imposing the necessity of a dramatic alteration in respiratory physiology

Let us consider the fetus as a fish, suspended in fluid, exerting an equal pressure over the surface of its body and within its open body cavities. Respiratory movement takes place causing a gentle circulation of fluid from the amniotic bath in which the child is suspended, through the mouth and into the trachea. These movements, the precursors of those to occur in extra uterine life, accomplish the end of maintaining the patency of the airway to fluid as well as synchronizing and developing the respiratory musculature. Adequate oxygenation is provided by the placental circulation. At birth, by vertex delivery, intra uterine pressure compresses the chest and upper airway, squeezing much of the fluid present out of the mouth and nostrils. This preparation for an atmospheric environment is accompanied by varying degrees of respiratory obstruction. If the baby is vigorous and awake as it were, that is if he is not under the influence of an anesthetic which has been administered to produce general anesthesia, basal anesthesia or asphyxiation (profound anesthesia), muscle tone and active reflexes help to keep open and clear the airway for the extra uterine respiratory effort. This effort, the accumulative effect of many repressed efforts, finally breaks through the existing obstruction and initiates subsequent rhythm. If the baby presents profound relaxation, obstruction and respiratory depression, these complications must be relieved or he will die. As expansion of the lung gradually takes place, this becomes evident in an increased tidal capacity which conversely might well be made the measure of respiratory progress. Premature infants by virtue of their immaturity present incomplete developments of terminal alveoli which is evidenced in varying degrees of antenatal atelectasis.

The practical results of the technique developed and described herein proved so satisfying that the author felt an obligation to offer this wherever it might prove of value. In the course of numerous addresses delivered to staff conferences the question arose as to

the similarity between asphyxia neonatorum and the asphyxia occurring in submersion, carbon monoxide poisoning, and other conditions requiring artificial respiration. It occurred to the reviewer that asphyxia was in reality a generic terminology, the specific instances of which were found in the many conditions bringing about acute asphyxiation frequently resulting in death. The test for such asphyxial death turned upon the reaction to artificial respiration. If artificial respiration was calculated to result in the saving of the life of the patient, the asphyxia was considered as an etiological cause of the generic condition. If the treatment of asphyxia, however, might be said to have no effect upon the course of the fatal condition—as in the case of septicemia, acute infectious diseases—this was not considered as an asphyxial death.


At the suggestion of Dr Alexis Carrel the vital statistics for New York City, covering the causes of asphyxial death noted were examined, and it was found that the total mortality from this cause exceeded 50,000 lives a year. As a result of these findings a Society for the Prevention of Asphyxial Death was incorporated in the spring of 1933 and through the courtesy of the New York Academy of Medicine, a one day's conference on the problem of asphyxia took place May 24, 1933. The importance of this gathering may be gathered from the speakers on the program: L. R. Williams, Shirley W. Wynne, H. P. Martland, Haven Emerson, T. A. Gonzales, D. J. Donovan, Chevalier Jackson, C. J. Imperator, Yandell Henderson, D. J. Edwards, E. B. Piper, H. J. Stander, P. N. Coryllos, H. B. Williams, John F. McGrath, Mr. W. A. Whitney, and Mr. Leon Senior.

(3) Later in the same year, an exhibit on asphyxia was set up at the Century of Progress in Chicago. In the course of these public activities which drew their origin directly from the successful results of resuscitation of the newborn, there accumulated experience to indicate that the technique described for asphyxia neonatorum by a simple adaptation of instruments, met the obligations presented by adult asphyxia in its many fields.

In the winter of 1934 a second conference covering a two day session, took place at the

OSTEOLYTIC OSTEOGENIC SARCOMA WITH A REPORT OF EIGHT FIVE-YEAR SURVIVALS

I S McREYNOLDS, M D, Houston, Texas

OSTEOLYTIC sarcoma of bone, because of its pulsating character and extreme vascularity and because of the hemorrhage and formation of new blood vessels seen under the microscope, was formerly regarded as an aneurism of bone. These features of the tumor are still aids in the diagnosis, although more than 50 years ago Sir James Paget voiced the opinion that the so called bone aneurism was essentially a tumor of bone. In more recent years, pathologists and surgeons as well have frequently referred to the tumor as a large round cell sarcoma.

Geschickter and Copeland have related the histogenesis of osteolytic sarcoma to the growth processes occurring in the skeleton subsequent to chondrification, explaining the failure of the tumor to form bone on the type and location of the tissue from which it arises. They consider the tissue of origin to be endosteum. This membrane takes part in the resorption of calcified cartilage and forms cancellous bone, and there is a marked similarity between the microscopic features of osteolytic sarcoma and that of ossification of the diaphysis in human embryos of 120 to 140 millimeters. The normal embryo, however, contains an abundance of calcified cartilage which supplies adequate amounts of mineral for subsequent ossification. This supply of calcium salts is not present to the same extent in individuals with osteolytic sarcoma, and so the formation of preosseous tumor tissue is out of all proportion to the formation of bone. That osteolytic sarcoma is definitely osteogenic is borne out by the formation of bone in pulmonary metastatic nodules. It is a tumor of very primitive tissue and, as in the case of all tumors of similar nature, it has an unusually rapid growth and very malignant characteristics.

The systemic findings, such as elevation in temperature, increase in pulse rate, and rise in total white blood cell count are similar to those of osteogenic sarcoma in general. The pulse rate is sometimes increased out of proportion to the temperature, the increase in rate probably being due to toxicity from the tumor. With the advanced cases there is an anemia proportionate to the stage of the disease. Some patients present a marked loss of weight early in the course of the disease, and this is probably produced by the pain, loss of sleep, anxiety, and the resultant anorexia. Following amputation of the affected limb such patients often show rapid gain in weight.

The boggy and indurated feeling when the tumor is palpated is the result of subcutaneous edema and hemorrhage. The pulsation sometimes observed is produced by a large cavity in the bone, erosion of the cortex and extreme vascularity, so that the tumor is expansile with each systole. This vascularity, as mentioned previously, is an aid in the diagnosis of the tumor. Many surgeons at exploration of osteolytic sarcoma have met with almost uncontrollable hemorrhage. Blood or blood stained fluid is a frequent manifestation of this form of sarcoma whether in the primary tumor or in the fluid aspirated from the pleural cavity in metastatic lesions. The presence or absence of soft tissue swelling is dependent upon the amount of extension of the tumor through the broken cortex.

The characteristic roentgenological finding is a lytic process. The destruction usually produces in the early stages a moth eaten appearance because of the interposition of areas of normal density among the areas of rarefaction produced by the tumor tissue. The growth may be located centrally or just beneath the cortex, and with progress of the disease there results a periosteal reaction which may be manifested by lipping, fuzziness, or by splitting and interruption of the continuity of

From the Surgical Pathological Laboratory of the Johns Hopkins Hospital and University, Baltimore, Maryland

anatomy and the physiological pathology of the baby's airway. Treatment should follow recognized surgical principles whenever conditions permit, i.e. exposure of the field, treatment under direct vision.

The surgical director will find it helpful to set up a routine designed to meet accepted surgical principles of treatment in the simplest manner possible.

If the condition calls for instrumentation, this should be practiced up to the limit of the benefits secured. It should be clearly understood that resuscitation apparatus is merely a means to an end. Anatomical, physiological and pathological complications occurring in asphyxia contra indicate the use of so called automatic apparatus—nothing can take the place of the intelligent application of simple instrumentation. The situation is too involved to hope for the best results without suitable theoretical training and practical experience. Every clinic cannot be an experimental laboratory. Properly directed research is and always has been the means of introducing new procedures but special training is required in order that judgment passed upon any practice may have value.

The reviewer's clinical experience in his attempt to carry out recognized principles is rehearsed from the point of view of the field as well as the armamentarium. Unusual conditions are discussed at some length. The need for research into the problem of atelectasis is stressed and a method of approach is suggested.

The importance of asphyxia neonatorum as it bears upon the entire field of asphyxia is emphasized. A brief resume is made to indicate that asphyxia of the newborn is the pivot upon which turns the present movement to prevent asphyxial death.

As a means of attacking the problem in a comprehensive manner, it is proposed that large clinics establish a department of pneumatology to control the use of gases employed for therapeutic purposes.

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varies in its clinical, roentgenological, and pathological features. In the review of the surviving cases presented here, particular care has been used in the microscopic classification. This was desirable since the clinical features of some of the living patients are slightly different than that expected in this type of tumor. Six of the patients had from one to four operative procedures prior to amputation. This finding in cured or arrested cases of sarcoma of bone has been reported by others, and would suggest in itself that the condition was less malignant. However, microscopic examination showed a highly malignant appearance in 6 of the survivals and none showed histologically borderline features between a benign and malignant condition. None of the cases except Case 7 (Path No 32663), presented from every angle the classical picture of osteolytic sarcoma.

Six of the patients were over the age of 19. In 4 cases the tumor was considered to develop as a primary lesion, and in 4 cases as a secondary lesion. In 2 cases the lesion probably developed at the site of giant cell tumor, and one possibly at the site of a cyst. The other secondary lesion developed in an individual complaining of arthritic symptoms for many years. One patient lived only 5 years and 9 months after amputation, and developed symptoms of metastasis in the chest 3 years prior to death. The metastatic area was kept under control by deep x-ray therapy. The reasonably comfortable prolongation of this patient's life is a recommendation for palliative deep x-ray therapy for pulmonary metastasis.

The methods of treatment in the cases studied do not allow any new suggestions for therapy. Primary amputation well above the location of the tumor, or radical resection if the case allows such a procedure, as soon as the diagnosis is confirmed is still the treatment of choice. The fact that minute deposits of tumor tissue are often present in the marrow spaces at some distance from the gross lesion accounts for the frequent recurrence in the amputation stump. It is supposed that metastasis occurs from continual small emboli of tumor cells in the pulmonary tissue until there is a successful transplant. Why metastasis

occurs up to 7 years after the amputation has not been satisfactorily explained. Whether the tissue is dormant in the chest or in some bone other than that involved originally or whether there is an additional occurrence of the tumor is a matter of conjecture. Though metastasis may occur in lymph nodes, in other soft tissue and in other parts of the skeleton, it is not common.

Some individuals hold that if the patient survived, the lesion was not a sarcoma of bone. Advocacy of this view will not help to lower the mortality in osteogenic sarcoma. A study of a large series of osteolytic sarcomas leads to the opinion that patients with more or less atypical lesions are the ones most likely to survive. The time elapsing before treatment is instituted for osteolytic sarcoma has a definite bearing on prognosis, notwithstanding the exceptional features of some of these cases in which patients have survived the 5 year period. In the past few years, rapid strides have been made in the early diagnosis of tumors of bone, but there probably has not been an accompanying increase in the rapidity with which sound and adequate treatment has been instituted.

CASE 1 Path No 10602 A white male, aged 30 years, injured his right shoulder in 1908 and had symptoms in this region until December, 1909, when a wrench of the arm fractured the upper humerus. Five months later there was a painful swelling at this site, and roentgenograms showed bone destruction above an oblique fracture. The tumor was curetted in May, July, August, and October, 1910. Coley's toxins were given and continued after an amputation through the shoulder joint was performed in 1911. In April, 1912 there was an amputation of the shoulder girdle for recurrence under the clavicle. Six years later the chest wall was invaded by tumor. The recurrence was treated with radium but the patient died with pulmonary metastasis 7 years after the second amputation. This was over 8 years after the primary treatment. The sections from the first operation have been lost. The pathological report describes a tumor composed of spindle and round cells with a large amount of hemorrhage. Huge round cells with malignant nuclei were present in the sections examined from the second operation.

CASE 2 Path No 14229 A white woman, aged 61 years, had pain and tenderness about the lower end of the right femur for 10 years. In May, 1913, she had an exacerbation of symptoms. The knee was flexed, motion was limited, and there was enlargement of the lower thigh with some distention of the knee.

the periosteum. These findings are aids to the roentgenological diagnosis. It should be remembered that osteolytic sarcoma may simulate in the x ray films the changes produced by giant cell tumor, bone cyst, metastatic hypernephroma, and metastatic carcinoma, though this is not the usual finding. Pathological fracture is common in osteolytic sarcoma occurring in weight bearing bones because of the rapidity of growth and the accompanying destruction of bone. Even moderate use of an affected limb during the development of the lesion predisposes to pathological fracture.

The tumor in the groins is most often hemorrhagic, friable, and contains some white fibrous tissue. It may resemble the tissue of giant cell tumor. Microscopically the predominant cells are large round cells and long oval or spindle cells with an abundance of chromatin material in the nucleus. Extremely bizarre nuclei may be produced during the stages of mitosis. Tumor giant cells with coalescence of two or more nuclei are frequently seen. These nuclear changes in the cells and their variations in shape indicate the primitive nature and anaplastic property of the tumor. Large and small giant cells of the epulis type are present and the number of nuclei may range from two to one hundred. Giant cells with few nuclei are more common. Geschickter and Copeland have referred to the typical plump or large spindle like cell as an abortive osteoblast. Collagenous or connective tissue material in various types of arrangement constitutes the stroma. Bone spicules and areas of osteoid tissue are less commonly found. Hemorrhage both as an extravasation of the red blood cells and as pools not enclosed by endothelial cells is a frequent finding.

In the entire group of 131 cases of osteolytic sarcoma recorded in the Surgical Pathological Laboratory of the Johns Hopkins Hospital there was a total of 117 cases in which the age was recorded. Fifty six or 47 per cent were from 11 to 20 years of age with an average age of 16 years. Approximately 16 per cent of the cases were from 21 to 30 and 8.5 per cent were in each of the next three decades. Only one case was under the age of 10. Seven were over the age of 60. There were 541 cases of

osteogenic sarcoma of all types recorded in this laboratory, osteolytic sarcoma representing 24.1 per cent of the entire group.

The bones most often involved in this series were in their order of frequency lower femur, upper tibia, pelvis, humerus, middle femur, and lower tibia. In 46 per cent of the cases the bones about the knee joint were involved. Trauma was a factor in the history of many cases, but the time interval and the severity of the injury were so inconsistent that no conclusions can be drawn.

In the present study the results of treatment in 131 cases of osteolytic sarcoma have been analyzed. Among these cases were 11 patients who lived longer than 5 years after treatment was instituted. Three of these cases formerly held to be osteolytic sarcoma were excluded because two had a marked resemblance to sarcoma of nerve sheath and the other presented the histological structure of synovial sarcoma. These cases were alive, 11, 10 and 28 years after radical resection or amputation and all of them consisted of a destructive lesion in the involved bone. The 8 remaining cases are reported in this article with an analysis of their clinical and pathological features.

Of 99 cases followed for a period of 5 years 8 were alive at the end of the 5 year period. Of the 8 cases 5 lived approximately 10 years or longer and 3 died with metastasis at 6, 7 and 7½ years respectively after operation. In all 92 per cent died from the effects of the tumor prior to 5 years and 94 per cent died within 8 years. The average duration of life after the primary treatment was 10.3 months in the patients dying within 5 years. If the patient lived for as long as 4 years after the amputation or radical resection the prognosis for permanent survival was much better. The 5 year period can be regarded as only an arbitrary measure of survival adopted for malignant conditions in general. Three per cent of the patients died as a result of the disease after 5 and under 5 years.

Osteolytic sarcoma occasionally arises in a benign giant cell tumor and this may account for the reports that some giant cell tumors metastasize fatally. It is well known that osteolytic osteogenic sarcoma is a tumor that

varies in its clinical, roentgenological, and pathological features. In the review of the surviving cases presented here, particular care has been used in the microscopic classification. This was desirable since the clinical features of some of the living patients are slightly different than that expected in this type of tumor. Six of the patients had from one to four operative procedures prior to amputation. This finding in cured or arrested cases of sarcoma of bone has been reported by others, and would suggest in itself that the condition was less malignant. However, microscopic examination showed a highly malignant appearance in 6 of the survivals and none showed histologically borderline features between a benign and malignant condition. None of the cases except Case 7 (Path No 32663), presented from every angle the classical picture of osteolytic sarcoma.

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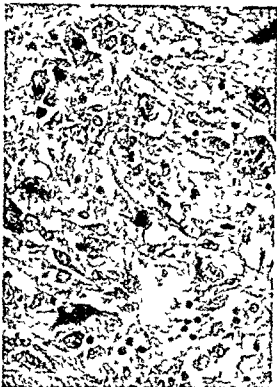


Fig. 1 Case 2 Path No. 14229 Photomicrograph of tissue obtained at amputation in 1913. The large vesicular nuclei and tumor giant cell indicate the malignant character of the tumor. The patient died of old age 11 years after amputation.

joint. Roentgenograms showed an enlargement of the lower end of the femur with rarefied areas in the marrow cavity that extended into the condyles of the femur. It resembled to some extent the appearance of a giant cell tumor. In June 1913 the knee joint was explored and upon finding bloody fluid in the joint that came through a crack in the cartilage of the lower femur the wound was closed, and amputation was performed through the upper third of the thigh. Both condyles were filled with a blood clot. Between there was soft white tumor tissue. Bone destruction was marked. Microscopic examination showed typical osteolytic sarcoma. There were epulis giant cells, tumor giant cells and long oval cells containing enlarged nuclei with much chromatin material. Marked malignancy was shown by the variation in nuclear structure (Fig. 1). The patient died of old age 11 years and 2 months after the amputation, with no suggestion of recurrence or metastasis.

CASE 3 Path No. 26877 This was a white male aged 30 years who was seen by the surgeon referring the case to this laboratory in 1900. He gave the following history. In 1916 irregular attack of pain



Fig. 2 Case 4 Path No. 27908 Photomicrograph showing fibrous character of the stroma. The nuclei of the cells are large, hyperchromatic and show frequent mitoses. Amputation in 1911, last reported well in 1931.

occurred in the right knee and 6 months later the knee was explored for internal derangement. The only positive finding was a congestion of the synovial membrane. He continued with symptoms while having Neisser serum and physiotherapy until 1920 when roentgenograms showed osteomyelitis or cyst formation of the upper end of the tibia. The tibia was opened and a gauze pack was left in. About 1 month later roentgenograms showed regeneration in the area of the removed bone and gave the examiner the impression that the process was osteomyelitis. After a report on the section from the exploratory operation amputation was performed November 22, 1920. The patient was last reported well 17 years later on August 23, 1937. Sections were interpreted as sarcoma of the fibrospindle cell variety. The sections available for study today are not perfect. However they are unquestionably sarcoma. Heavy collagenous fibers indicate that it is more definitely of the fibrospindle cell group. The osteoblasts are small and the cells are frequent mitotic figures.

CASE 4 Path No. 27908 A colored male aged 43 years came under observation complaining of a knot in the lower left leg. The enlargement developed shortly after a severe blow 18 months previously. Three months before his hospitalization the

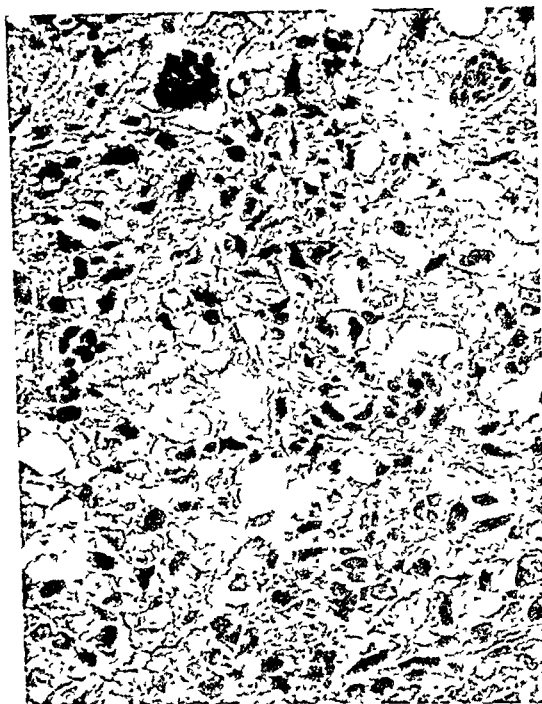


Fig 3 Case 5 Path No 29327 Photomicrograph showing giant cells of epulis type. The cells of the stroma show enlarged hyperchromatic nuclei. The malignant features of the tumor were less at the first operation. Patient is well 15 years after amputation.

swelling had developed to such an extent that it formed a collar around the leg and he had lost 7 pounds in weight. There was an increase in local temperature and the tumor was fluctuant. It did not pulsate. The highest temperature prior to operation was 101 degrees with a pulse rate of 120. The roentgenographic report was a marked destruction in the lower end of the tibia with periosteal bone proliferation and soft tissue swelling. Amputation was performed. The gross specimen showed marked destruction of the tibia. The tumor tissue was soft and extended upward in the marrow cavity. There was some bone formation among the debris of destroyed bone. The sections showed round and spindle cells in various sizes and shapes and many tumor giant cells (Fig 2). The patient was last reported well in 1931, 10 years after the amputation performed in 1921.

CASE 5 Path No 29327 A white male, aged 19 years, had pain about the left knee in June, 1920. He gradually became worse and in October, 1920, the area was incised, but no pus was found. The wound became infected and drained for 4 months. A short time later a roentgenogram showed a large cavity in the lower end of the femur. In November, 1921, the femur was opened. The cavity contained a



Fig 4 Case 6 Path No 31890 Low power photomicrograph showing malignant spindle cell character and large amount of osteoid material from the pulmonary nodule obtained at autopsy 7 years after amputation.

distinct wall and a large amount of blood was evacuated. The cavity was cauterized and the wound closed. The wound healed *per primam*. The pathological report was "giant cell sarcoma." On April 29, 1922, the tumor had recurred and was growing very rapidly. Roentgenograms showed destruction of bone. A mid thigh amputation was performed well above the growth, and examination of the sections showed large and small epulis giant cells, tumor giant cells, hemorrhage, spindle and large round cells (Fig 3). The tissue had a much more malignant appearance than that obtained at the previous operation. The patient was reported well 15 years after the amputation.

CASE 6 Path No 31890 A white male, aged 35 years, was seen in 1908. He gave a history of pain and swelling at the lower end of the femur of 7 months' duration. Roentgenograms showed a central destructive lesion of the tibia. The lesion was curetted and the microscopic report was giant cell tumor. There was a recurrence 13 months after the curettage, and the leg was amputated. The patient died 7 years after the amputation with metastasis in the lungs. The only sections available are from the metastatic nodule, and show both fibroblasts and osteoblasts with many giant cells of the epulis type. There is a great deal of osteoid material. Many of the cells have a malignant appearance (Fig 4).

CASE 7 Path No 32663 A white male, aged 20 years, came under observation with a history of pain in the left upper arm followed by soreness and loss of

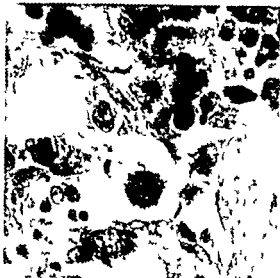


Fig 5 Case 8 Path No 41194 High power photomicrograph showing marked evidence of malignancy. Note the bizarre nuclei. Patient well 9 years after radical treatment

function. Two months prior to his admission to the hospital in December 1922 he had fallen and fractured the humerus. Upon admission roentgenograms showed a fracture of the surgical neck with many areas of rarefaction. The arm was explored and tissue thought to be inflammatory was removed. In January of 1923 swelling and induration of the arm were noted. The condition became progressively worse and a shoulder joint amputation was performed on March 17 1923. Sections from the tumor showed typical osteolytic sarcoma with fibroblasts osteoblasts and numerous tumor giant cells. Some osteoid tissue and bone formation were noted with adjoining areas of cartilage. There were giant cells with few to many nuclei. The patient developed metastasis in the chest in 1925 but lived 3 years longer. At death 5 years and 9 months after amputation he was thought to have metastasis in the pelvis also but this was not verified.

CASE 8 Path No 41194 This was a male aged 14 years who gave a history of striking his left leg severely 3 weeks before examination. There was moderate swelling soon after. Examination showed a fusiform swelling at the upper end of the left tibia. The tissue was dense and boggy to palpation and there was a slight increase in local heat. The leg was immobilized in extension and pain was lessened.

Roentgenograms showed a destructive process involving the inner half of the tibia at its upper end limited by the epiphyseal line. The cortex was destroyed. The area was explored on the assumption that the process was an infectious one. The tissue found in the destroyed bone could be wiped away with a sponge. The walls of the cavity were irregular and there was a moderate amount of hemorrhage. The area was cauterized and packed. Later massive doses of radium were placed in the cavity and deep x ray therapy was given over the groin and pelvis. The maximum temperature prior to the operation was 100.2 degrees with a pulse rate of 90 to 120. He had at times a pulse rate of 120 with a normal temperature. The leg was amputated on June 1 1929 6 months after the first operation. The cavity was rather extensively infected and there was no evidence of tumor tissue. Sections made from the material removed at the first operation show a great deal of hemorrhage. The tumor cells are variable in size and shape most of them being large and round or oval cells. Bizarre nuclei are present and some osteoid material is seen (Fig 5). The patient is well today 8 years after the first operation.

It will be noted in this series of cases of osteolytic sarcomas with survival of more than 5 years after treatment that half of the cases occurred in the second decade of life and only 2 patients were under the age of 20. Several of the 5 year survivals had one or more operative procedures prior to amputation, but in all radical surgery was ultimately instituted. The microscopic findings in some cases were suggestive of a higher degree of malignancy than was to be expected from the duration of symptoms and roentgenological appearances. Five year survivals are less likely in the primary tumors of young individuals, with a brief duration of symptoms.

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APPENDICITIS IN CHILDHOOD

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JUST fifty years ago Reginald Fitz published a remarkable monograph on the treatment of inflammation of the vermiform appendix. Since that time the literature has been filled with articles on the subject, but surprisingly little can be added to the conclusions he reached, even today after all the statistical, pathological, and bacteriological studies which have accumulated since then. I hesitate to add anything to this deluge of articles which has flooded the medical journals, but after 50 years just as many people are dying of appendicitis as ever, in fact, there are good reasons to believe that more people die each year of this disease than did 30 years ago. Walker made a study of the available vital statistics and hospital records and concluded that while in the better hospitals the operative mortality was decreasing, the mortality per 100,000 of population is increasing. It is estimated that in the United States alone 20,000 persons die annually of appendicitis. This condition is a disgrace to the medical profession and until it is corrected we must not for a moment allow interest to lapse in the early diagnosis and proper treatment of the disease. We must not, as we might easily do, shift the blame to an ignorant laity who will not consult their physicians early but wait until the effects of ice bag, cathartic, and time have been tried and the golden opportunity for a simple, safe, and easy cure has passed. The attitude of the laity is largely our fault, and we should keep hammering at laity and profession alike for early diagnosis and treatment.

Dissatisfaction with the present conditions has manifested itself in recent years, by a tendency to departure from the old dictum to operate as soon as the diagnosis has been made. Numerous surgeons in this country and abroad have advocated a return to Ochsner's method of treating the late cases complicated by peritonitis. We have carefully reviewed

our cases at Babies Hospital during the five years 1930-35 and have reviewed the recent literature to determine if we should change our policy of early operation.

AGE AND SEX

For some reason appendicitis is much more common among boys than among girls. No satisfactory explanation of this fact has been advanced. In this series the preponderance is not as marked as in most others, where it is in the neighborhood of two to one. Of our 220 cases 124 were boys and 96 girls. Beekman had 91 males to 54 females. The mortality is usually reported to be higher in females.

No age is immune to appendicitis, cases having been reported in which perforation occurred *in utero*, however, the disease is very rare before the age of two. In 1916 Abt could find only 80 cases in patients less than 2 years old. Just why there should be such a marked difference in the incidence of appendicitis before and after the age of 2 no one knows, but the change to a solid diet and assumption of the erect posture probably influences it. The fact that we had 12 cases in 5 years indicates that it is more common than is usually supposed and that the diagnosis is frequently missed. After 2 years, there is a steady increase in the incidence until the second decade when it reaches the maximum. The age incidence in Beekman's, Woodall's, and our own series is shown in Chart I.

PATHOLOGY

Appendicitis is not a specific disease entity. There are numerous precipitating factors and almost any organism may be encountered. In children, as in adults, the vast majority show some mechanical block to the lumen of the appendix. This is most frequently a fecal concretion, but may be an angulation or fibrotic obliteration of the lumen. However, there is not necessarily a mechanical factor. The intact mucosa is not impervious to invasion by pathogenic organisms, and the large amount

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TABLE I

Author	Number cases	Pain		Vomiting	
		% Present	% First symptom	% Present	% First symptom
Caldwell	110	99	7	83	11
Beckman	141	100		90	
Stone	258	100	97	86	4
Mueller	58	100		73	
Mars	50	100	90		6

of lymphoid tissue in the appendix in children make it especially vulnerable to attack.

The pathology in no 2 cases is exactly alike and we believe the simplest classification is the best. We have included no cases of 'chronic "recurrent," "subacute," or "catarrhal," appendicitis since interpretation of such terms varies so much that they are practically meaningless. We have confined our selves to three groups: (1) *acute*—acute inflammation of all the coats of the wall may or may not have cloudy fluid in the peritoneal cavity, (2) *acute with abscess*—perforation has occurred but the process has been walled off with formation of an abscess, (3) *acute with spreading peritonitis*—perforation with thick pus in the peritoneal cavity with no localization. Spreading peritonitis is a better term than general or diffuse peritonitis for we do not explore the abdomen hence do not know definitely how general the process is. Fibrinopurulent peritonitis is merely the later stages of the same process.

DIAGNOSIS

The diagnosis of appendicitis in children is not more difficult than in adults in spite of the usual inability to get a full and accurate history and the frequent inability of the patient to co-operate. The symptoms and signs are not vastly different but we have to depend more on the cardinal symptom of pain and the fundamental sign of localized tenderness.

Pain is the first and predominating symptom in the vast majority of cases. In fact Lord Moyrhan stated that if pain was not the first symptom, appendicitis could be dismissed. Like most dogmatic generalizations this is an error. We had one case in which



Chart 1. Age distribution of 660 cases as reported by Beckman, Woodall and Caldwell.

there was at no time any evidence of pain. This was a 6 year old girl who had had symptoms, the first of which was vomiting, for 30 hours before admission. Bolling reports 3 cases in which there was no pain. In 169 of our cases pain was the first symptom not noted in almost all cases it is at first generalized and may or may not become localized in the right lower quadrant. Frequently it is referred to the region of the umbilicus even late in the disease. Table I shows the incidence of pain and vomiting in 3 large series.

Vomiting is the next most frequent symptom, being present in 192 of the 270 cases. It ushered in the attack in 24. It was absent even in some of the late cases with abscess or diffuse peritonitis. Vomiting was present in 86 per cent of Stone's cases and was the first symptom in 8 of 258 corresponding fairly closely to our experience.

Other symptoms are of more or less minor importance. Constipation is much more frequent than diarrhea. In fact diarrhea occurred in only 12 of our cases in 12 of which it was the first symptom. Anorexia and nausea are hard to evaluate in children, but are usually present. Unusual symptoms, such as headache, convulsions or dysuria, may be the first to be noticed by the parents. One child first complained of pain on voiding and red blood cells and leucocytes were found in the urine. At operation an acutely inflamed retrocecal appendix touching the ureter was found.

Fever is probably always present in the early stages of the disease but frequently on admission to the hospital the temperature is normal or subnormal. This may be true in any stage of the disease. The temperature averages higher in the later stages but in the individual case it is of no help in determining whether general peritonitis, abscess, or localized peritonitis is present, since the extreme range of temperature is about the same in all groups. In our acute cases the average temperature on admission was 100.4 degrees F. with a range from 98 to 104 degrees. In the cases with abscess the average was 101.4 degrees F. with a range from 99 to 105 degrees. In cases with spreading peritonitis the average was 101.9 degrees F. with extremes of 99 to 105 degrees. Beekman reports almost identical figures.

The degree of leucocytosis is of little diagnostic or prognostic value. Ochsner long ago said that the white count was of value chiefly in following the postoperative course. Beekman says that "from a diagnostic or prognostic standpoint no deductions could be drawn" from the white blood count. Table II shows the white count and the percentage of polymorphonuclear neutrophils in the different groups. We have not used the sedimentation rate in enough cases to draw conclusions but doubt that it is of great value in children.

The most important physical sign, as in adults, is localized tenderness. Although in some children it is difficult to interpret it is safe to say that it is invariably present. Rebound tenderness, psoas sign, skin hyperesthesia are refinements which are occasionally useful, but we have to depend on the one all-important sign—localized tenderness—and be patient and careful in the examination until we can get the child to co-operate, allowing a fair evaluation of the amount of tenderness. Spasm and rigidity are late signs and merely corroborate the tenderness. Rectal examination is more frequently helpful than in adults because in the small pelvis the examining finger reaches relatively higher.

DIFFERENTIAL DIAGNOSIS

We made numerous diagnostic mistakes in the period covered by this report and have

TABLE II

	Acute	Abscess	Acute with peritonitis
Temperature			
Average	100.4	101.4	101.9
Maximum	104	105.2	105
Minimum	98	99	99
White blood cells			
Average	15,000	21,200	18,700
Maximum	33,000	37,000	44,000
Minimum	5,000	9,000	4,000
Polymorphonuclear neutrophils, %			
Average	82	83	82
Maximum	98	92	97
Minimum	29	71	19

taken out approximately forty normal appendices. This is due to our policy of exploring whenever there is a reasonable chance that we are dealing with an early acute appendicitis.

The most frequent condition which we mistake for acute appendicitis is an acute mesenteric lymphadenitis following an acute upper respiratory infection. The infective organisms presumably are swallowed, pass through the intact intestinal mucosa, and cause inflammation of the mesenteric nodes which are most numerous about the ileocecal region. The signs and symptoms may exactly simulate those of acute appendicitis and I know of no way to differentiate between the two, with certainty, in all cases.

Food poisoning may simulate acute appendicitis. The products of many organisms, including certain strains of staphylococci and streptococci, have been found to cause intestinal upsets. These attacks are usually ushered in by violent vomiting and diarrhea with abdominal pain. Localized tenderness is rare, but may be present. We are suspicious of any case in which diarrhea is an outstanding symptom, especially if it is the first symptom, since this occurred only twice in our series.

The early symptoms of pneumonia may be largely abdominal. The tenderness and pain are usually in the upper quadrants, however, and careful physical examination and fluoroscopy should prevent this mistake. Primary peritonitis is uncommon, but in some cases is almost impossible to differentiate. On rare occasions a diagnostic puncture is justified.

TREATMENT

The chief point of contention in the treatment of appendicitis is immediate or delayed

TABLE I

Author	Number cases	Pain		Vomiting	
		% Present	% First symptom	% Present	% First symptom
Caldwell	220	69	77	33	21
Beckman	215	100		60	
Stone	258	100	97	86	3
Mueller	35	100		73	
Mars	250	100	90		6

of lymphoid tissue in the appendix in children make it especially vulnerable to attack.

The pathology in no 2 cases is exactly alike and we believe the simplest classification is the best. We have included no cases of "chronic," "recurrent," "subacute," or "catarrhal" appendicitis, since interpretation of such terms varies so much that they are practically meaningless. We have confined our selves to three groups (1) *acute*—acute in inflammation of all the coats of the wall, may or may not have cloudy fluid in the peritoneal cavity, (2) *acute with abscess*—perforation has occurred but the process has been walled off with formation of an abscess (3) *acute with spreading peritonitis*—perforation with thick pus in the peritoneal cavity with no localization. Spreading peritonitis is a better term than general or diffuse peritonitis for we do not explore the abdomen, hence do not know definitely how general the process is. Fibrinopurulent peritonitis is merely the later stages of the same process.

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The diagnosis of appendicitis in children is not more difficult than in adults in spite of the usual inability to get a full and accurate history and the frequent inability of the patient to co-operate. The symptoms and signs are not vastly different but we have to depend more on the cardinal symptom of pain and the fundamental sign of localized tenderness.

Pain is the first and predominating symptom in the vast majority of cases. In fact Lord Moynihan stated that if pain was not the first symptom, appendicitis could be dismissed. Like most dogmatic generalizations this is an error. We had one case in which



Chart 1. Age distribution of 660 cases as reported by Beckman, Woodall, and Caldwell.

there was at no time any evidence of pain. This was a 6 year old girl who had had symptoms, the first of which was vomiting, for 36 hours before admission. Bolling reports 3 cases in which there was no pain. In 169 of our cases pain was the first symptom noticed, in almost all cases it is at first generalized and may or may not become localized in the right lower quadrant. Frequently it is referred to the region of the umbilicus even late in the disease. Table I shows the incidence of pain and vomiting in 5 large series.

Vomiting is the next most frequent symptom, being present in 192 of the 220 cases. It ushered in the attack in 24. It was absent even in some of the late cases with abscess or diffuse peritonitis. Vomiting was present in 86 per cent of Stone's cases and was the first symptom in 8 of 258, corresponding fairly closely to our experience.

Other symptoms are of more or less minor importance. Constipation is much more frequent than diarrhea. In fact diarrhea occurred in only 12 of our cases, in 2 of which it was the first symptom. Anorexia and nausea are hard to evaluate in children but are usually present. Unusual symptoms, such as headache, convulsions or dysuria, may be the first to be noticed by the parents. One child first complained of pain on voiding and red blood cells and leucocytes were found in the urine. At operation an acutely inflamed retrocecal appendix touching the ureter was found.

cause there was great doubt as to the diagnosis. There were 2 deaths in the 10 cases, a mortality of 20 per cent, compared to 4 deaths in the 210 cases with intermuscular incisions, or 1.9 per cent. This is an unfair comparison and means little, but Colt compared the mortality of the intermuscular incision to that of the paracentral in two large series done by the same surgeons. The mortality in the 403 cases in which the intermuscular incision was used was 2.99 per cent while in the 696 cases done through a paracentral incision the mortality was 6.47 per cent. Mont Reid reports that at the Cincinnati General Hospital the adoption of the McBurney incision cut the mortality approximately in half. This seems to be conclusive statistical proof of what we are absolutely certain to be true, that the intermuscular incision is the one of choice. Not only is the mortality less but the incidence of hernia is markedly less, the hospital stay is shorter, and the convalescence smoother.

There is no question that better exposure is obtained by a long rectus incision but we have never failed to be able to remove an appendix through the McBurney incision. In this connection we would make two points regarding operation through an intermuscular incision in children. The incision should be made higher than is ordinarily done in adults; it should be entirely above the line between the umbilicus and the anterior superior spine. The rotation of the colon is more apt to be incomplete in children, hence the appendix is higher; also, the difficult appendices to remove are the retrocecal ones in which the tip is fixed at the level of the hepatic flexure. The low or pelvic appendices are attached to mobile ceca which can be lifted out and the appendix removed with ease through any incision. If the tip of the appendix is not easily delivered, the base should be divided and the cecum returned to the abdominal cavity. The appendix is then freed from base to tip. It is surprising how frequently this maneuver makes an otherwise difficult job easy and simple.

As to whether to invert the stump of the appendix or not we feel that the simplest surgery is usually the best surgery; so we simply ligate and carbolize the stump. The purse-string suture with inversion and covering the

site with omentum is not only a waste of time and a useless refinement but is surgically unsound.

There has been a tendency to less and less use of drains in recent years and for good reasons. We drain only in those cases in which there is an abscess or other local focus. If there is marked induration or necrosis of the cecal wall, a fecal fistula is apt to form and a drain should be left in. Only soft cigarette drains are used. Diffuse or localized peritonitis is not in itself an indication for drainage and convalescence is faster if the abdomen is closed and the peritoneal infection left to nature's defenses. In doubtful cases, however, in which there is very thick pus or much fibrin deposited about the region of the cecum, it is safer to insert a soft drain as it does little or no harm and may prevent the formation of an abscess. In drained cases the peritoneum should be sutured and the remainder of the abdominal wall packed lightly with iodoform gauze. Suturing muscle and fascia in the presence of gross infection merely spreads the infection, causes sloughing of the fascia, and increases the chances of a mixed or anaerobic infection. I have never seen a serious infection of the abdominal wall develop in a wound that was packed open. The incidence of ventral hernia following appendectomy with drainage was found by Pool to be 16 per cent if the wound was sutured and 7 per cent if it was left open. Bancroft and Beekman have also found that suture of the peritoneum only is preferable to closure of the fascia and muscles as well in the drained cases.

In the cases with spreading peritonitis it is not unusual for secondary abscesses to form after the removal of the appendix. These usually develop in the pelvis and occur whether drainage is or is not used. We believe that watchful waiting is the best policy in caring for these, as more than half will be absorbed without operative intervention. Some will rupture spontaneously into the rectum. The others should be drained but not until well localized and walled off. If one waits until the mass is well defined and "points," it is usually possible to drain it through a small wound and without soiling the free peritoneal cavity. There were 15 such secondary ab-

operation in the cases complicated by peritonitis. During recent years many surgeons have advocated the Ochsner method of treatment—starvation, morphine, and rest until localization has occurred. Some have even gone so far as to set a definite time limit—if they cannot operate in the first 36 or 48 hours, they routinely adopt the so called conservative treatment. This is not logical, for time is only one of the important factors in the disease. Some appendices are gangrenous, and there is a spreading peritonitis within 3 hours of the onset of symptoms, others will rupture a week or 10 days after the onset. Nor is it possible to tell from the history and physical findings whether peritonitis is present or not. Frequently in children with a rigid abdomen we find at operation a fairly early appendicitis with cloudy fluid or thin pus in the peritoneal cavity. On culture this fluid is sterile or shows a pure culture of *Bacillus coli*. If the appendix is removed at this stage we may confidently expect a rapid and uncomplicated recovery. On the other hand if the appendix is not removed the walls disintegrate and a mixed infection with streptococcus, staphylococcus, and other organisms develops, and in these mixed infections the mortality, as Meleney has shown, is very high under any treatment.

It is true that I have had little experience with the Ochsner treatment, but from the experience of other fair observers I am not encouraged to adopt it. Woodall in a total of 205 cases in children had 22 deaths. Thirteen of these had received the Ochsner treatment. Seven died before they were thought suitable for operation and 6 died after drainage of abscesses. His conclusion is that "young children do not stand the starvation or Ochsner treatment nearly as well as adults." I believe that even in the late cases in which we are certain that we are dealing with a general peritonitis the appendix should be taken out as soon as possible. This does not mean immediately on admission but as soon as the child can be gotten in the best possible condition for operation, as soon as dehydration and acidosis have been corrected by infusion, and, in those needing it, a blood transfusion has been given. Morphine is given in the meantime to give the child much needed rest.

A good example of how we believe the late cases of peritonitis should be treated is T F No 349,252. This was a 93 year old negro girl who was admitted 6 days after the onset of symptoms. She was desperately ill, dehydrated, with sunken eyes, temperature 104.6 degrees F, pulse, 160, thready and weak, there was frequent fecal vomiting. The abdomen was distended and board like throughout. She was given morphine, and an infusion of 300 cubic centimeters of 5 per cent glucose in normal saline and a continuous drip venoclysis at the rate of 200 cubic centimeters per hour, and a direct transfusion of 250 cubic centimeters. At the end of 8 hours she was in much better shape and the appendix was removed through an intermuscular incision. She left the operating room with a pulse slower and stronger than when she entered it. The peritoneal cavity was full of pus, and the appendix with fecalith had ruptured. She developed a subhepatic abscess which was drained through a separate intermuscular incision. Otherwise she made an uneventful recovery. These children stand operation well but they do not stand a gangrenous appendix left to reach its final stages of fibrinopurulent peritonitis and multiple abscesses.

Frequently a patient comes in with a long history and a mass in the right lower quadrant, the question arises whether to operate immediately or wait for further localization of the process. We always operate immediately and in fully 30 per cent of the cases we find an unruptured, acutely inflamed appendix buried in a matted mass of omentum and small intestine. It is certainly better to have the appendix cleanly out than to wait for abscess formation with the possibility that the local defenses will not be adequate and a general peritonitis ensue, or a mechanical ileus or a suppurative thrombophlebitis. We wholeheartedly agree with Urban Maes who says "Undoubtedly immediate operation is the wiser plan in children just as it is in any age."

Only 10 times in these 220 cases was a right rectus incision made. In all others the Mc Burney incision was used. In these 10 cases the rectus incision was made because an abscess had pointed near the midline, or be

R. W., No 231,721, male, aged 3 years 9 months, duration of symptoms, 5 days Temperature was 105 degrees F, white blood cells, 12,000, with 87 per cent polymorphonuclears. No pre-operative treatment was given. The McBurney incision was used. Acute appendicitis with spreading peritonitis was found. Patient died 10 hours after operation. Again no attempt was made to get this child into condition for operation. Operation was a mistake and hastened death.

R. H., No 187,623, male, 9 years of age, duration of symptoms, 18 hours. Temperature was 101.4 degrees F, white blood cells, 4,600 with 88 per cent polymorphonuclears. Patient was in good condition on admission to hospital and an acutely inflamed appendix with fecalith was removed through a McBurney incision. After operation he ran a septic temperature, liver and spleen became enlarged, and he developed jaundice. Death occurred on the eleventh day, presumably from multiple liver abscesses. No autopsy.

Liver abscess following septic portal thrombophlebitis is the gravest complication of appendicitis. Fortunately it is rare. Except for gentle handling of tissues and avoidance of mass ligation of the mesoappendix we have no suggestions as to its prevention.

F. S., No 222,802, female, aged 3 years, duration of symptoms, one month. Temperature was 99 degrees F, white blood cells, 9,000. Large well localized pelvic abscess was found at operation, it was drained after adequate pre-operative treatment, and the appendix was not removed. Patient died suddenly 4 hours after operation. The cause of death was unknown but probably was a pulmonary embolus.

H. R., No 317,605, male, aged 14 months, duration of symptoms, 4 days. White blood cells, 19,000 with 63 per cent polymorphonuclears. Clysiss of glucose solution was given before operation. The McBurney incision was used. A ruptured appendix with spreading peritonitis was found. Patient vomited during operation and aspirated part of the vomitus. Direct transfusion and continuous drip venoclysis were administered after operation. Patient died 36 hours after operation from pneumonia.

Of our 6 deaths 3 were apparently unavoidable. In the other 3, grave surgical mistakes were made which were probably large factors in the fatal outcomes. In view of our responsibility for these deaths we are glad to be able to report a mortality appreciably lower than any similar series so far reported. One impor-

tant factor in obtaining this low mortality was the close co-operation between the pediatricians and the surgeons. The care before and after operation was under the constant joint supervision of the medical and surgical staffs; a sound principle in all surgery but especially true of the surgery of childhood.

Of the 12 infants under 2 years of age 3 died, a mortality of 25 per cent. Although this is lower than the 50 per cent mortality reported by Abt, it is still unreasonably high and we believe can be reduced by proper pre-operative care. Dehydration and acidosis must be corrected before operation and it is possible that a blood transfusion should be a routine pre-operative procedure, certainly one should be prepared to give a transfusion at, or immediately after, operation. The same is true of patients at any age who have a leucopenia. We have found this to be a very grave prognostic sign and believe that all should have the benefit of a transfusion before and, if necessary, after operation.

While we are not satisfied with our mortality rate, it does give us confidence in our method of treatment and makes us believe that the principles are sound. We have no intention of dropping tried methods and adopting the delayed or Ochsner treatment. We are confident that our mortality would have been much higher if we had treated our late cases by that method.

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TABLE III—MORTALITY

Author	Acute		Acute with abscess		Acute with spreading peritonitis		Total	
	Cases	Mortality	Cases	Mortality	Cases	Mortality	Cases	Mortality
Caldwell	101	57	50	10	67	60	220	27
Woods							295	7.45
Tasche	38	16	33	90	11	27.3	82	8.5
Keves	90	102	122	00	42	38.1	63	18.0
McLanahan	125	0	28	0	26	16.0	179	3.0
Kaiser	154	75	46	6.5	55	23.0	255	5.6
B. Kman	48	0	53	5.7	44	15.2	145	7.6
Stone	147	0	72	6.0	43	34.0	262	
Bolling							123	8.1
Maes	127	0	84	8.3	50	50.8	261	7.6
F. ney	1.5	1.7	40	1.0	30	31.0	193	6.2
Haggard	1650	7	10	Adults 5.0	127	24.7		
F. ney		3.4		4.5		25.0	4000	

scases in this series, in only 3 of which was operative intervention necessary. The others were absorbed or ruptured spontaneously.

Nearly all of these children are suffering from more or less severe acidosis and are dehydrated when they enter the hospital and the parenteral administration of glucose and saline should be used freely before and after operation. We have found the use of pitressin, as advocated by Potter useful in preventing and combating postoperative distention. In children under 7 we use one half cubic centimeter or 10 u every 4 hours beginning before operation and continuing until the danger of ileus is past. In children over 7 the full adult dose of 20 u is given.

MORTALITY

Table III shows our mortality and that of other series in children. It is usually stated that mortality in children is higher than in adults. Our figures show that this is not necessarily true. The recuperative power of the child is remarkable. It is true that the disease progresses faster than in the adult and that a larger percentage will enter the hospital with spreading peritonitis. Whether this is due to the small and undeveloped omentum as is frequently stated we have no way of know-

ing, but we rather believe it is just another instance that all vital processes proceed more rapidly in the growing body.

The greatest factor in the mortality, of course is the duration of the disease before operation. In the early cases, when operation is done before rupture has occurred, the mortality should be, and is, negligible. In our acute cases the average duration of symptoms before patient entered the hospital was 13 days, in the peritonitis cases it was 27 days, and in the cases with abscess it was 40 days.

A brief analysis of our deaths follows.

S. N. No. 328,421, female, aged 2 years, duration of symptoms, 5 days. Temperature was 103 degrees F., 9,000 white blood cells per cubic millimeter with 62 per cent polymorphonuclear neutrophils. Exploration was done through a right rectus incision. The peritoneal cavity was found to be filled with thick pus. The appendix was not removed. Cigarette drains were placed in the pelvis and region of the appendix. Death occurred 24 hours after operation from peritonitis and sepsis. No autopsy.

This child had no pre-operative treatment. In view of the high mortality at this age she should have had a transfusion and infusion of venoclysis before operation. Appendicitis at this stage is not an immediate operative emergency and 6 to 12 hours should be devoted to getting the patient into the best possible condition for operation. It was a great mistake to use a right rectus incision as there is no comparison between the shock to the patient in exploring through a McBurney, rather than a rectus, incision.

S. W. No. 222,851, female, aged 20 months, duration of symptoms 30 hours. Temperature was 101.6 degrees F., white blood cells, 4,000, polymorphonuclears 10 per cent. The abdomen was rigid throughout. Patient was operated upon immediately without pre-operative treatment. An acutely inflamed appendix with a fecalith and spreading peritonitis was found. Patient died on the operating table. Death was called an anesthetic one.

The remarks on the previous case apply doubly strongly here. A baby under 2 years of age with leucopenia, peritonitis, and dehydration was subjected to exploration through a right rectus incision without pre-operative treatment. This was a surgical crime rather than an anesthetic death.

Material Inflamed tubes and ovaries removed at operation from 24 consecutive patients (Table I) were used as material for this investigation. All of the patients, as may be seen in Table II, had been under observation for some time, and most of them had been afebrile for at least 2 weeks.

Method Immediately after their removal at operation, cultures of the tubes and ovaries were taken. A sterile platinum loop was inserted through an incised opening in the tubal wall and passed toward the cornual end. Small pieces of exudate and tissue were obtained. In cases in which pus was encountered, cultures were made from it. The media used was 5 per cent horse blood-agar plate, hydrogen-ion concentration 7.5. Several plates from each tube were streaked. The plates were examined at the end of 24 or 48 hours. Smears were made from every suspicious colony and stained by the method of Gram. When gonococci were found by smear the plate colonies were recultured. In a few instances the initial colony showed degenerate forms of microorganisms (Fig 1). On subculture these microorganisms assumed the usual morphological characteristics of the gonococcus (Fig 2). Gonococcus complement fixation tests were performed in 20 of the 24 cases.

Results Among the 24 cases studied there were 16 positive cultures of gonococci, or in

66.6 per cent. Positive cultures were obtained only from pieces of tissue and exudate. Cultures from pus were negative for gonococci.

Table II summarizes the 24 cases studied. The details are tabulated to show the results of the examination of cervical and urethral spreads, the duration of the salpingitis according to the history, the results of cultures of the tubes and of gonococcus complement fixation tests, and the naked-eye pathological changes observed at operation. Special interest was taken in the history in order to estimate as closely as possible, the duration of the salpingitis. The estimated duration ranged from 1 month to 10 years, the average being 18 months. All spreads were taken on admission and were seldom repeated, so that too much value cannot be placed on a negative report. Only one positive cervical spread is recorded among the 24 cases.

In 20 of the 24 cases, specimens of blood were sent to the New York City Board of Health Laboratories for gonococcus complement fixation tests. There is no apparent uniformity in the results of these tests and those of tubal cultures. Of 12 cases showing positive complement fixations, cultures were positive in 7 and negative in 5. Of 4 cases in which the complement fixation tests were negative, cultures were positive in 3. In 3 cases in which complement fixation tests were reported as

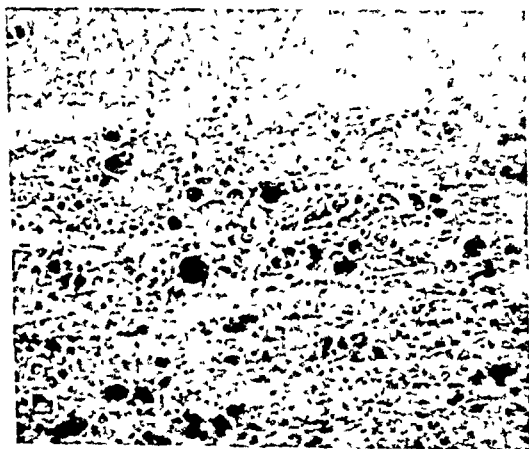


Fig 1 Smear stained by Gram Weigert method. Taken from colony showing degenerate forms of gonococci. Note expanded irregular forms.

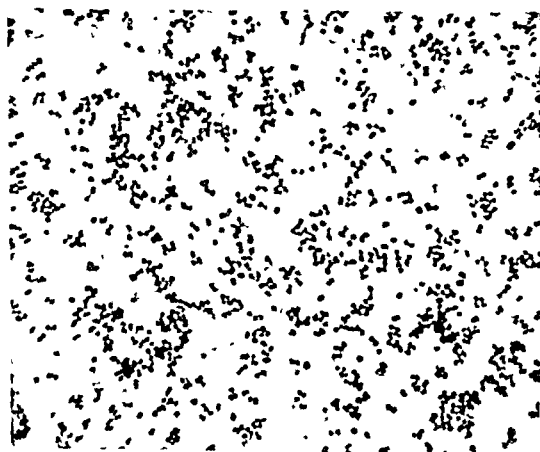


Fig 2 Smear stained by Gram Weigert method. Taken from colony obtained by subculture showing return to characteristic appearance of gonococcus.

THE PERSISTENCE OF GONOCOCCAL INFECTION IN THE ADNEXA

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GONORRHEAL salpingitis pursues a variable course. In some cases recovery is complete, in others the disease becomes chronic, although acute exacerbations may be frequent. The cause of the variations observed clinically has given rise to much speculation and to some experimental work on the duration of gonorrheal infection in the fallopian tube. The literature, previous to 1921, leads one to believe that the gonococcus is to be demonstrated in the inflamed fallopian tubes and ovaries less often than one would expect from the clinical phenomena presented. Menge, in 1897, found the micro-organisms present in 22 of 126 cases of purulent salpingitis or in 21.7 per cent. Hyde found them in 18.9 per cent of a series of 2,973 collected cases. Andrews reported positive growths in 22 per cent of 634 cases studied. These figures are reported from Crossen because the original articles could not be found. In 1921, Curtis undertook a further study of this problem using inflamed fallopian tubes and ovaries which had been ground. He reported that in 192 cases there were 19 positive cultures of gonococci, or in 9.8 per cent. Of the 192 cases gonococci were not demonstrated in any case that did not at the same time reveal evidence of recent inflammation. He felt that the micro-organisms are rapidly killed, and that they are rarely recoverable in cultures later than 2 weeks after the disappearance of fever and leucocytosis. Since Curtis' work, nothing has been added. It is apparently the consensus that there is a bacteriolytic process which takes place in the actively inflamed fallopian tube that disposes of gonococci. However, in 1925, Wagner stated that in his opinion "the repeated flareups which are typical of gonorrheal salpingitis suggest

that the organisms do not entirely disappear from the pyosalpinx even though they cannot be demonstrated in culture." This seems to be the only dissenting opinion.

The present study was undertaken to determine, if possible, whenever the gonococcus is persistent in cases that are clinically and pathologically recognized as chronic salpingitis. The results obtained are at variance with the older observations and for this reason warrant publication.

TABLE I—PRE OPERATIVE TEMPERATURE
COURSE IN HOSPITAL—24 CASES

Name	Number of febrile weeks (over 99°)	Number of afebrile weeks (below 99°)	Culture	Gonococcus complete or absent
AS	2	2	+	Not done
ED	7	1	O	Not done
SC		3	+	+
SH		3	O	+
ES	4	2	+	D
BJ	1		+	+
MD		3	+	+
FR		1	O	D
AMc	7	0	+	O
CD		1	O	+
MJ		2	+	+
WG		3	O	+
LS		4	+	D
LO	4	4	+	Not done
RH			O	+
MB		0	+	O
BG		0	+	+
FW		2	O	+
LP			+	O
GT		5	+	Not done
AB		2	+	+
OB		2	+	
AP		2	+	+
DP	3		O	O

From the Obstetrical and Gynecological Service (T. D. D. V. section) Bellevue Hospital. The Department of Obstetrics and Gynecology, The Department of Urology, New York University and from the Laboratory of Pathology, Bellevue Hospital.

Material Inflamed tubes and ovaries removed at operation from 24 consecutive patients (Table I) were used as material for this investigation. All of the patients, as may be seen in Table II, had been under observation for some time, and most of them had been afebrile for at least 2 weeks.

Method Immediately after their removal at operation, cultures of the tubes and ovaries were taken. A sterile platinum loop was inserted through an incised opening in the tubal wall and passed toward the cornual end. Small pieces of exudate and tissue were obtained. In cases in which pus was encountered, cultures were made from it. The media used was 5 per cent horse blood-agar plate, hydrogen-ion concentration 7.5. Several plates from each tube were streaked. The plates were examined at the end of 24 or 48 hours. Smears were made from every suspicious colony and stained by the method of Gram. When gonococci were found by smear the plate colonies were recultured. In a few instances the initial colony showed degenerate forms of microorganisms (Fig 1). On subculture these microorganisms assumed the usual morphological characteristics of the gonococcus (Fig 2). Gonococcus complement fixation tests were performed in 20 of the 24 cases.

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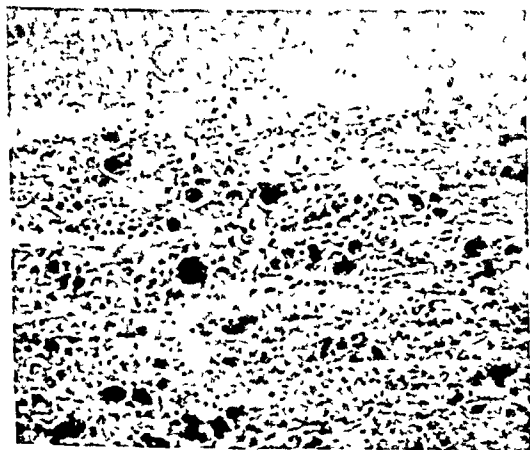


Fig 1 Smear stained by Gram Weigert method. Taken from colony showing degenerate forms of gonococci. Note expanded irregular forms.

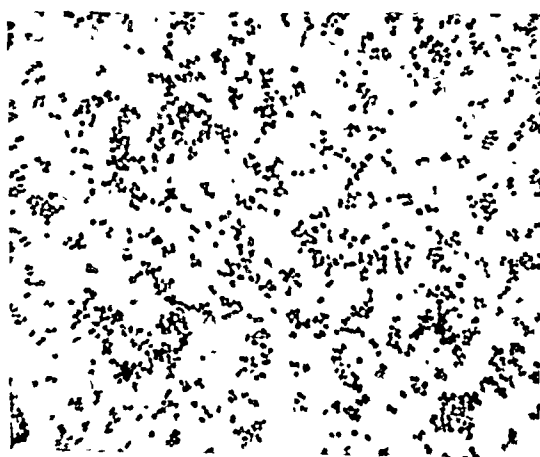


Fig 2 Smear stained by Gram Weigert method. Taken from colony obtained by subculture showing return to characteristic appearance of gonococcus.

TABLE II—SUMMARY OF CASES FROM WHICH CULTURES WERE OBTAINED

Name	Cervical spread	Extragenital spread	Culture from tube	Duration of illness	Gonococcus found	Notes on extra-genital lesions
A S	Not done	Not done	Pos	Also 3 months Pain and discharge	Not done	Abcess left ovary Left pyosalpinx
E D	Neg	Doubtful	Neg	2 months Vaginal bleeding and lower abdominal pain	Not done	Tubo-ovarian abcess
S C	Neg	Neg	Pos	1 year Pain with periods	Positive	Bilateral pyosalpinx
S H	Not done	Not done	Neg	2 months Vaginal bleeding and lower abdominal pain	Positive	Bilateral pyosalpinx and ovarian abcess
E S	Neg	Doubtful	Pos	2 months Left lower quadrant pain Clots with periods	Doubtful	Tubo-ovarian abcess
B J	Neg	Neg	Pos	7 months Pain with profuse gait on of periods	Positive	Bilateral tubercular salpingitis and pyosalpinx
M D	Neg	Neg	Pos	4 years Left lower quadrant pain	Positive	Right pyosalpinx
F H	Not done	Not done	Neg	6 months Pain and swelling in left lower abdomen	Doubtful	Tubo-ovarian abcess
A Mc	Neg	Neg	Pos	1 year and 2 months Pain, tubercular abscess ruptured peritonitis	Negative	Bilateral ovarian abcess
C D	Neg	Neg	Neg	1 month Metrorrhagia with pain, lower abdominal men	Positive	Staphylococcal abscess with perforation of uterus
M J	Neg	Neg	Pos	6 months Lower abdominal pain with metrorrhagia	Positive	Tubo-ovarian abcess, fibromyoma
W G	Neg	Doubtful	Neg	1 year Lower abdominal pain, menorrhagia Leucorrhoea	Positive	Bilateral tubercular salpingitis and metrorrhagia
L S	Neg	Neg	Pos	2 months Lower quadrant pain with discharge	Doubtful	Subperitoneal abscess
L O	Not done	Not done	Pos	1 year Intermenstrual pain, menorrhagia	High	Tubo-ovarian abcess
R H	Neg	Neg	Neg	1 month Pain in peritonium and lower abdomen, discharge	Positive	Ductal tubercular salpingitis and peritonitis
M B	Not done	Not done	Pos	1 year Left lower quadrant pain by gynecological	Negative	Right pyosalpinx and metrorrhagia, peritonitis
H G	Neg	Neg	Pos	3 months Left lower quadrant pain Pain, genital infection	Positive	Left tubo-ovarian abcess
F W	Neg	Neg	Neg	6 months Pain, genital infection, drainage	Positive	Chronic salpingitis Tubo-ovarian abcess
L P	Not done	Not done	Pos	1 year Frequent abortion, menorrhagia, peritonitis	Negative	Fibromyoma Old left tubo-ovarian abcess
G T	Neg	Doubtful	Pos	5 months Left lower quadrant pain	Positive	Left tubo-ovarian abcess, left tubercular salpingitis
A B	Pos	Neg	Pos	1 year Lower abdominal pain with menorrhagia	Positive	Chronic salpingitis, pyosalpinx
O B	Not done	Not done	Pos	1 year Lower abdominal pain	Positive	Subperitoneal abscess, ovarian abcess, peritonitis
A P	Neg	Neg	Pos	6 months Right lower quadrant pain	Positive	Right tubercular salpingitis
D H	Neg	Neg	Neg	5 years Left lower quadrant pain	Negative	Left tubercular salpingitis and peritonitis

doubtful, cultures were positive in 2. This serves to show that the gonococcus fixation test was not a reliable index of infection in the patients under consideration.

Pathology The naked-eye pathological changes are summarized in Table II.

Microscopic sections were studied in all cases. On the basis of the type of exudate and the degree of fibrosis present, one may formulate the following grades of salpingitis. (1) Acute salpingitis, characterized by a rich exudate of polymorphonuclear leucocytes in the stroma and lumen, and injection of small blood vessels with few or no structural alterations in the tube. (2) Subacute salpingitis, the exudate consisting largely of plasma cells, lymphocytes, and eosinophils with marked structural changes in the walls of the tube. (3) Acute exacerbation of chronic salpingitis in which reaction similar to that of Type I is present together with marked structural changes. (4) Chronic or healed salpingitis showing little if any active inflammatory reaction, and marked structural changes in the walls of the tube.

Among the specimens removed at operation, no example of acute exudative salpingitis was found (Type I). Nineteen were regarded as subacute salpingitis and from them 13 positive and 6 negative cultures were obtained (Type II). Two specimens were classified as acute exacerbations of chronic salpingitis (Type III) and both gave positive cultures. Three specimens were classified as chronic or healed lesions (Type IV) and of these one gave a positive culture.

The microscopic diagnoses of the changes in the tubes and their relationship to the gonococcus as the causative factor, are summarized in Table III.

The following cases are of special interest and are reported in detail.

CASE I. Mrs. L. P., 29 years of age, colored. In 1933 the patient was admitted to the Gynecological Service at Bellevue Hospital and operated upon for a left tubo-ovarian abscess. In an attempt at conservative surgery, the left tubo-ovarian abscess was injected with turpentine and mineral oil. Post-operative diathermy was given. The patient did well until 1936, when she developed menorrhagia and pain in the left lower abdomen. She was readmitted in May, 1937, for this complaint, and was again

TABLE III—THE RELATION OF CULTURAL FINDINGS TO THE HISTOLOGICAL PICTURE IN THE INFLAMED TUBE

	Total	Positive culture	Negative
Type II Subacute salpingitis	19	13	6
Type III Subacute salpingitis with superimposed acute inflammatory reaction	2	2	0
Type IV Chronic (healed) salpingitis	3	1	2
	24	16	8

operated upon, that is to say, 4 years after the turpentine injection. At operation an intraligamentous fibromyoma was found and the left tube (previously injected with turpentine) was found to be about three times the normal size, thickened, clubbed, and closed, it was covered with adhesions. Culture from the tube was positive for gonococci. The gonococcus complement fixation test and cervical spreads were negative.

CASE 2. Mrs. M. B., Spanish, 48 years of age. The patient's chief complaint was that of violent pelvic pain which had been present for 10 years. It was described as of a "twisting" nature, occurring in the left lower quadrant, occasionally severe enough to cause her to faint. During the first episode of this sort she was in Mexico, and a curettage was done. Since that time there have been recurrences of pain similar in character and distribution. Her husband died 10 years ago, and she claims to have had no intercourse since then. She has been sterile for 20 years. On physical examination she was believed to have a cystic mass in the right adnexa, the nature of which was questionable, the pre-operative diagnosis was ovarian cyst. She had no fever while under observation for 2½ weeks. At operation, on April 13, 1937, a right sided hydrosalpinx was found, forming a mass 4 inches in diameter, adherent in the cul-de-sac and bound to the side of the pelvis by dense adhesions. Culture from the hydrosalpinx was positive for gonococci, and the colony was recultured in pure growth. The gonococcus complement fixation test and spreads were negative.

CASE 3. Miss A. B. The patient was found on admission to have a positive cervical spread. Her chief complaint of left sided pain in the lower abdomen was of a year's duration. Examination revealed a tender, left sided adnexal mass, 5 by 5 by 6 centimeters in diameter. The temperature ranged between 99 and 100 degrees for the first week. She was given a hyperpyrexia treatment on two occasions at a temperature of 107 degrees for 8 hours. In addition, she received eight Elliott treatments alone. Cervical spreads, repeated after hot-box treatment, were negative for gonococci. She was

afebrile 2 weeks prior to operation. At operation May 13 1937 chronic left sided salpingitis was found together with an abscess of the corresponding ovary. The abscess was 5 centimeters in diameter and the adjacent tube was clubbed firm closed, and thickened. Cultures from the ovary and tube were positive for gonococci and the gonococcus fixation test was positive.

SUMMARY

Twenty four patients suffering from salpingitis were investigated bacteriologically. Of this number 66.6 per cent were found to harbor gonococci in spite of the fact that none of them was in the acute stage of the disease. In 1 case it seems likely that the most recent infection took place at least 10 years ago. In another the tube had been injected with turpentine. In a third, fever therapy had apparently cured the local cervical infection. Gonococcus complement fixation tests were found to be frequently at variance with the results of culture. While the recovered gonococci were occasionally degenerate in form, they

rapidly assumed the usual characteristics on subculture.

CONCLUSIONS

1. Contrary to previous reports, the fallopian tubes may remain as active foci of gonococcal infection for long periods of time.

2. Many cases regarded as acute exacerbations of chronic salpingitis may be due to recrudescences of residual infections rather than to reinfections.

3. Gonococci may survive in the tube in the presence of turpentine and mineral oil.

4. Gonococci may survive in the tube despite apparent cure of local cervical infection by hyperpyrexia.

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EXPERIMENTAL METHODS OF LUNG COLLAPSE

Fascial Transplantation and Bronchial Ligation

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THE lung is constantly distended by two forces which work simultaneously on both sides of its alveolar membrane. One is external, the negative pleural pressure which exerts an outward pull, the other is internal, the air under atmospheric pressure which distends the alveolar membrane.

If the lung is freed from the negative pleural pressure it will retract itself to a relaxed state. If the bronchi are obstructed the lung will no longer remain normally distended, and after absorption of the contained air, will adopt its initial volume, a condition of atelectasis. The former is the explanation of the mechanics of a pneumothorax, and the latter is the explanation of what we observed in bronchial ligation. Pneumothoracic collapse therapy in pulmonary tuberculosis is successful in a high percentage of cases in which adhesions do not prevent a satisfactory collapse of the cavity. All too frequently, however, a broad band or irregular adhesion between the lung and chest wall, too large to be safely divided, prevents collapse of the cavity and a so-called "hanging cavity" results. Thoracoplastic collapse therapy, when indicated, is usually successful in producing a satisfactory collapse of pulmonary cavities. Occasionally, however, circular, fairly thin walled cavities refuse to collapse completely but simply move over to the mediastinum (behind the sternum) with collapse of the chest wall. Eloesser, in his exhaustive study of this type of lesion, concluded that as yet there is no satisfactory operation for uniformly meeting this problem.

Nissen and Fick (3) tried the envelopment of pulmonary lobes of healthy dogs with silk in an attempt to produce pleural adhesions which would facilitate lobectomy in cases of bronchiectasis. Wolfe and Van Allen com-

pressed lobes of normal animals with a rubber sac hoping to obtain pulmonary collapse by the formation of a thick capsule of fibrous tissue in the visceral pleura. In both of these sets of experiments there was a considerable diminution in the volume of the compressed lobe which was transformed into a retractile hilar stump. On the other hand the pleural reaction due to the foreign material was the cause of death in several of the animals of the latter workers.

From the results noted we felt that the procedure might be better tolerated by substituting organic transplants for the inorganic materials heretofore employed. Consequently, it was planned to attempt pulmonary collapse with transplants of fascia.

EXPERIMENT

Five normal dogs were used. The chest was opened, the selected lobe was brought out, and the fascial transplant sewed around it. In 2 cases the right middle lobe was selected and in the 3 remaining dogs, the left upper lobe was collapsed. The chest was closed. The dogs were killed after 3 months and autopsies were performed.

Technical details. After a preliminary injection of morphine each dog was prepared for a sterile operation. The fascial transplant was first taken from the leg. Subsequently, in order to have enough material, it was taken from the abdominal wall (rectus sheath). Under ether-intratracheal anesthesia and positive pressure, the pleural cavity was opened by an 8 centimeter incision in the fifth intercostal space. The selected lobe was brought out and its volume reduced by spontaneous relaxation by decreasing the positive pressure. The fascial transplant was then sewed snugly around the lobe so as to cover all its surface beginning at the hilus and following toward the periphery with interrupted sutures. Care was necessary not to constrict the ves-

From the Department of Surgery of the University of Chicago. This work was done under a grant from the Douglas Smith Foundation of the University of Chicago.



FIG. 1 a Dog 738 Roentgenogram of chest taken 4 weeks following fascial collapse of the right middle lobe b Photograph of specimen of Dog 90 sacrificed 3 weeks fol-

lowing fascial collapse of right middle lobe c Photograph of specimen of Dog 90 sacrificed 3 months following fascial collapse of the left upper lobe

sels at the hilus since two of the first animals died of gangrene of the lung. The intratracheal pressure was increased, the other lobes were inflated to exclude the pneumothorax and the chest wound was closed.

The operation was always very well tolerated, there was no operative mortality. The postoperative course was closely observed. No dyspnea or cyanosis developed. Frequent radioscopic and radiographic examinations were made (Fig. 1 a).

The first two dogs died, the 3 remaining ones were sacrificed and examined by autopsy, 1 and 3 months after the operation. Gross and microscopic examinations of the lungs were made, particularly of the collapsed lobe.

Results. Two of the 5 normal dogs died of gangrene of the lung due to compression of the blood vessel 2 or 3 days after operation. The other dogs made an uneventful recovery. Two days after operation they became active and began to behave normally. After 3 months a roentgenographic examination showed the side of operation to be somewhat flattened, the ribs and diaphragm on the same side limited in motion, the heart drawn a little to the collapsed side, and the postoperative lobe atelectatic.

Gross postmortem findings. At autopsy the lobe operated upon was found to be attached

to the surrounding parts by dense adhesions but no exudate was present. One month after the operation the collapsed lobe was shrunken to one fourth and 3 months after the operation to one seventh of its original size. The cut surface of the lobe had the dark purple brown color of atelectasis (brown firm, and atelectatic). By the end of 3 months the lobe was less than half as large as it was when relaxed by opening the chest. The other lobes were distended and occupied the space which was no longer occupied by the collapsed lobe and it was probably on this account that the heart and diaphragm were saved from becoming extensively displaced in compensation for the reduction of size of the treated lobe (Fig. 1 b). The fascial transplant was always found to be in a desirable position surrounding the collapsed lobe. On subsequent examinations the fascial envelop appeared decreased in size, thus causing a reduction in the size of the compressed lobe (Fig. 1 c). Microscopic findings revealed complete atelectasis of the collapsed lobe (Fig. 2 a and b).

Protocol 1 (Dog 738) August 13, 1936. Fascial transplant around the right middle lobe. The operation was performed under ether intratracheal anesthesia following a preoperative dose of morphine. A long incision was made in the right thigh and a large piece of fascia was obtained. The right chest

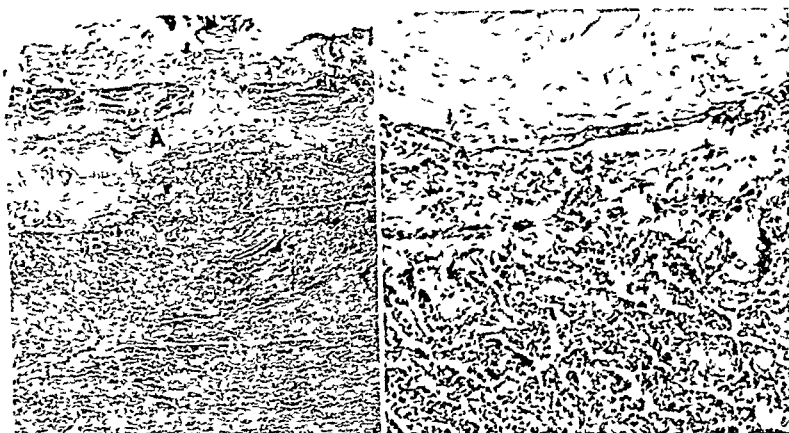


Fig 2 a, left L P Photomicrograph of specimen 3 weeks following fascial collapse Note the fascial capsule, A, and the atelectatic lung tissue, B b, high power at B (Fig 2, a) showing atelectasis

was opened through the fifth intercostal space, and the fascial transplant was sewed snugly about the middle lobe. The chest was closed in three layers with silk sutures. The incision in the leg was also closed.

August 14, 1936, the dog ate little and appeared somewhat weak. August 16, 1936, the dog was much better and ate normally. August 20, 1936, the dog appeared sick due to the infection of the leg wound. Care was taken of the wound. September 5, 1936, the dog appeared normal except for a little infection in the leg wound. September 12, 1936, fluoroscopy revealed no exudate, the shadow at the right of the heart was smaller than in the previous examination. September 15, 1936, roentgenograms were taken. The animal was electrocuted. Postmortem examination was made. No pleural exudate was found.

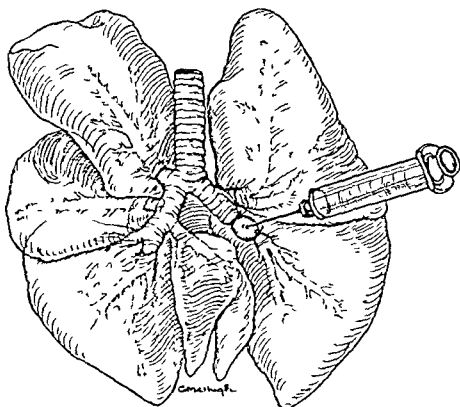


Fig 3 a, Illustration demonstrating the method of injection of silver nitrate following double ligation of a bronchus

The right middle lobe enveloped in the fascia was very much reduced in size and adherent to the lower lobe. Microscopic sections revealed atelectatic lung tissue.

Bronchial ligation A second method of producing lung collapse that we wish to present is by bronchial ligation. As far back as 1850 Gairdner published a paper with the following subtitle "Collapse of the Lung Connected with Bronchial Obstruction." In 1879 Lichtheim showed that the air absorption occurring in bronchial obstruction was accomplished by the blood circulating in the alveoli, in fact if the branch of the pulmonary artery corresponding to the obstructed bronchus was ligated, atelectasis did not occur. In 1923 Nissen studied bronchial ligation and drew the conclusion that it would never have any practical application. In 1933 one of us reported



Fig 3 b, Dog 147 Roentgenogram of chest 8 weeks following collapse of the left lung by bronchial ligation. Note collapse of lung and deviation

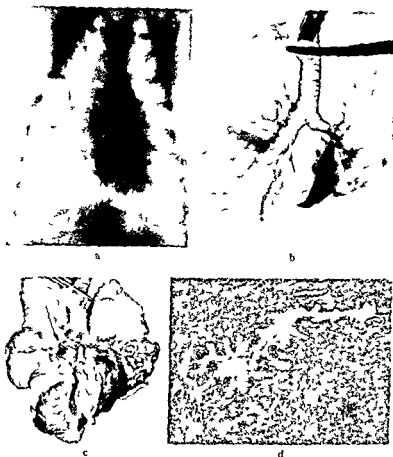


Fig 4. a Dog 590. Roentgenogram of chest 4 months following collapse of left lower lobe by bronchial ligation. b Roentgenogram of specimen of Dog 590. Note collapse of left lower lobe of 4 months duration. c Photograph of specimen of Figure 4. b. d Photomicrograph of collapsed left lower lobe. Note complete atelectasis.

a method of closing the bronchi from within by the silver nitrate technique (W. E. A. 1). This method so successful in the treatment of experimental lung tuberculosis has not yet reached the stage of clinical application in that disease. It seemed that the bronchial secretions washing out the silver nitrate were the cause of the incomplete bronchial occlusion in the human cases in which it was used. An attempt was made to obviate this by keeping the silver nitrate confined to the desired locations by means of the following method. The primary bronchus of one or two lobes was doubly ligated with linen and 1.20 to 1.10 cubic centimeter of a 10 to 35 per cent solu-

tion of silver nitrate was injected into the bronchus between the two ligatures just before or after the distal ligature was applied. In order to test the efficacy of this procedure before applying it to the treatment of tuberculous cavities of the lung, an attempt was made in healthy animals. It was hoped to obtain changes in the anatomy and physiology of this ligated lobe, i. e. production of atelectasis and interruption of its essential normal function the gas exchange. Furthermore it is well known that if air is no longer present in the alveoli the functional circulation carried out by the pulmonary artery becomes unnecessary and the irrigation of the atelectatic lobe

is accomplished, chiefly by the nutritional artery (the bronchial artery) The ligated lobe is put at complete rest,—perhaps more complete than by any other known method of collapse, and in a state which is considered ideal for the healing of tuberculosis of the lung

Technical details Ether was administered by the intratracheal insufflation method at a pressure of from 20 to 35 millimeters of mercury The chest was opened through an incision in the fifth intercostal space The lung was reflected anteriorly and the primary or the stem bronchus was isolated from the surrounding tissues A double ligature of linen was passed about the bronchus, care being taken to avoid including the bronchial artery and the bronchial nerves in the ligatures The central ligature was tied, and before the distal ligature was approximated $1/20$ to $1/10$ of a cubic centimeter of a 10 to 35 per cent solution of silver nitrate was injected into the bronchus between the two ligatures (Fig 3, a). After having lost an animal due to the *necrosing* action of 35 per cent silver nitrate upon the lung structure, the injection of the silver nitrate was postponed until after both ligatures had been tied Thus the solution could not spread distally nor centrally to the ligature In some cases the insufflation was interrupted for a few seconds to allow collapse of the lung, and after its collapse the ligature was firmly tied The insufflation was again started, and the total occlusion of the bronchus tested by attempts to distend the lung The chest was then closed with pericostal sutures, sometimes the other lung being strongly distended with air before the last suture was tied, and normal respiration re-established by removing the insufflation tube from the trachea This operation required only a few minutes for its performance, and was carried out in each case without mishap Even when the right or left primary bronchus was ligated the operation was well tolerated It was interesting to observe that the acute occlusion of a completely normal functioning lung (i e one-half of the respiratory system) could be so well endured This confirmed the recent clinical observation in pneumonectomy for carcinoma of the lung At the moment of the ligation the heart beat became slower but the respiratory rate in-

creased in frequency The postoperative symptoms were observed Frequent fluoroscopic and x-ray examinations were made and no exudate was demonstrable Atelectasis developed and the mediastinum and diaphragm were displaced toward the collapsed lobes especially when the whole lung had been collapsed (Fig 3, b) The displacement of these structures was much less if only one lobe had been obstructed (Fig 4, a) Bronchoscopic examinations were made and bronchial occlusion verified in all but 3 cases In 1 dog the ligature cut through the bronchial wall and was observed at bronchoscopy.

Results Of the 12 dogs used, 4 died. In 3 the cause of death was independent of the bronchial ligation (1 died of opening of the chest 11 days after operation, 1 died of pneumonia of the opposite lung 4 days after operation, 1 died of a pre-existing infection of one of the two lobes ligated (the other lobe was atelectatic at postmortem, 9 days after operation), the fourth dog died 3 days after operation due to necrosing action of the silver nitrate (35 per cent) which spread into the lung parenchyma Eight dogs survived The immediate effects of the operation were not severe The dogs were active and ate with a relish In some animals, dyspnea was observed especially when a complete lung was occluded Three of these reopened later, one of which had been ligated about the left primary bronchus The others remained closed (The bronchi remained closed in 3 of the 4 dogs which died from other causes)

Autopsy findings The space left by the collapse of the lobe was obliterated, various factors taking part. the remaining lobes became distended, the mediastinum was displaced toward the collapsed lung, and the diaphragm on that side became somewhat elevated The lobe operated upon appeared shrunken to one-fifth to one-eighth of its normal size It was bluish-red in color and of the consistency of liver (Fig. 4, b and c) The ligature was found intact in all but 1 case On sectioning with a knife, the cut surface bled but was of increased density Bronchi and bronchioles were present on the cut surface but other lung structures were obliterated Microscopic examination revealed the alveoli completely void of air

or exudate. Thus ligation of a primary bronchus produced complete atelectasis of its corresponding pulmonary lobe. In the only animal in which the bronchus reopened, a picture of bronchiectasis was found. Probably the pre-existing infection was the cause of its reopening.

Protocol 2 Dog No 590 Under ether intratracheal anesthesia and positive pressure, the left chest was opened through the fifth intercostal space. The pulmonary ligament was cut. The lung was reflected anteriorly. The left inferior bronchus was ligated after being carefully freed from the surrounding vessels. The bronchus was doubly ligated with silk and 0.2 cubic centimeter of a solution of 35 per cent silver nitrate was injected between the ligatures. The chest was closed.

Postoperative course The day after the operation the animal was up and ate well. At the end of the week it appeared entirely well. May 16, 1937, fluoroscopic and radioscopic examinations were made and atelectasis of the left lower lobe was observed. The heart had been displaced to the left and the diaphragm was somewhat elevated.

June 11, 1937, bronchoscopy revealed the left lower bronchus closed. June 20, 1937, fluoroscopy revealed no exudate, left lower lobe atelectatic. September 10, 1937, fluoroscopy and x-ray examinations of the chest were made. The animal was sacrificed by electrocution. At autopsy no fluid was present in the chest. The left lower lobe bronchus was occluded and the lobe was atelectatic. The rest of the lung was normal.

EVALUATION OF STUDY

Collapse of a lung lobe by means of a fascial transplant was accomplished more easily by allowing spontaneous relaxation of the lobe by a short interruption of intratracheal positive pressure. Excessive compression of a lung lobe with fascia appears to be dangerous. If the amount of fascia is insufficient, the process should be limited to partial enclosure of the selected lobe. The best results were obtained with a large piece of fascia which enabled us to maintain the lung in a position of spontaneous relaxation, thus avoiding dangerous compression. The operation was well tolerated, the free transplant always took, and there was no pleural exudate. In two dogs sacrificed 3 months after the operation, pleural adhesions fixed the atelectatic lobe to the chest wall. These adhesions, however, did not interfere with centripetal retraction of the enclosed lobe which was completely atelectatic. Ex-

amination of the specimens showed that there was no obstruction of the primary bronchus. Thus the mechanism of production of this form of collapse is different from that of the other method, i.e., bronchial ligation. As a rule there was no displacement of the mediastinum but whenever it occurred it was not pronounced. The bronchial ligation was technically the easier operation.

Four days after the operation was the shortest period after which a ligated lobe was examined and the lung appeared already atelectatic at that time. However, the ligated lobe continued to decrease in size and increase in consistency when more time had elapsed following ligation. The bronchial lumen was completely occluded at the point of ligation. The bronchi immediately distal to the ligation appeared somewhat dilated and filled with mucus. Microscopic examination revealed the peripheral bronchi compressed, the lumen being much reduced in size. The alveoli were airless and a passive congestion of the tissues existed. The displacement of the surrounding structures (mediastinum, diaphragm, etc.) was very much less pronounced when only one lobe was occluded than when the whole lung was ligated. It is well to remember in this connection that the mediastinum of the dog is very movable, especially much more than the same structure in the human. After careful studies it is today well known that the functional compensation of the remaining tissue is sufficient even in the case of ablation of an entire lung.

The results of collapse therapy in pulmonary tuberculosis are not always those desirable. In 128 cases studied by Ulrici, only 23 per cent of ten year cures were obtained. Consequently the trial of new methods is justifiable.

Theoretically, fascial collapse should have some advantages over a pneumothorax, i.e., a more complete continuous rest of the diseased part, a true selective collapse limited to the tuberculous lobe, no reactivation of the process after re-expansion of the lung, a shorter period of treatment (social problem) and probably like the other methods of constant collapse (thoracoplasty) more permanent cures.

Thoracoplasty does not completely relax the lung since the intrapleural pressure remains negative. Also its compression is exerted mainly in one direction, i.e., from the side. There is the danger of mediastinal displacement and the compression of the heart and its great vessels, and finally thoracoplasty is a traumatizing and deforming operation.

The fascial collapse maintains complete relaxation of the lobe and produces a centripetal collapse in all directions of the affected lobe. The compression is independent of the mediastinal instability, the procedure is not traumatic, and does not alter the form of the chest. In cases of so called hanging cavities or in which the thoracoplasty fails to produce complete collapse of the cavity a clinical trial of fascial collapse is justifiable.

SUMMARY

Two methods of producing collapse of the lung have been described. One consisted of surrounding a lung lobe with an envelop of living fascial transplant. The other entailed the double ligation of a primary bronchus, avoiding the bronchial arteries, and the injection of a solution of silver nitrate between the

ligatures. Massive atelectasis of the lung tissue was obtained with both methods but, in the case of the fascial transplant, the bronchial passage was maintained intact. The procedures were not complicated by the development of a pleural exudate. A clinical trial of the fascial type of collapse is justifiable in cases of hanging cavities or in uncollapsed cavities following thoracoplasty.

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THE PHYSIOLOGY OF THE UTERINE MUSCULATURE

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OUR knowledge of the physiology of muscle has advanced considerably since the time that the phenomena of contraction, retraction, and polarity as manifested by the uterus were discussed by Dubois and Pajot, Duncan, Galabin, Horrock, and Cazeaux. In this paper we desire to analyze the different types of activity of the uterine musculature, in the light of modern physiologic concepts and terminology. Such a consideration delineates certain problems bearing on the interpretation of certain abnormal states of uterine motor activity.

During the course of our study of the comparative physiology of the uterus (35), we have become more and more conscious of the need of terms with which to describe accurately the physiologic changes manifested by the muscle fibers of different portions of the uterus acting simultaneously. The term "retraction," although it is descriptive of what occurs in the upper uterine segment as a whole in labor, is not descriptive of the change occurring in the individual muscle fibers. In the lower uterine segment relaxation of the muscle fibers occurs in a gradual step like manner. They are not completely relaxed because they are able to resist stretch in an active manner. It is stated generally that the lower uterine segment is stretched and thinned, but this does not describe the change in the individual muscle fibers. The change that occurs in the lower uterine segment as a whole might be referred to as "receptive relaxation" or "postural relaxation" terms that have been used to describe, for example, the relaxation that occurs in the fundus of the stomach and other parts of the gastrointestinal tract when material enters. Such terms are descriptive of the process as a whole but do not tell us that the muscle fibers have elongated and become relatively fixed at an increased length under which condition they manifest the same ten-

sion, or as some would say, the same "tone". The term "tone" has been given so many connotations that it has become necessary to qualify it, and many students of muscle physiology at the present time avoid the use of the term because of the confusion it engenders.

In our previous papers on the comparative physiology of the uterus, we have attempted to avoid the use of the term "tone" in so far as possible. Because of the lack of an adequate descriptive physiologic term, with which to describe the change of the muscle fibers of the upper uterine segment in labor which results in the phenomenon of "retraction," we have referred to it as an *isometric contraction* which is inexact and which, if adhered to, would give a new connotation to the term. For these reasons, we believe that it is timely to discuss the subject of the physiology of the uterine musculature and to seek more adequate and exact descriptive terms of the changes manifested.

The uterus from the beginning of pregnancy undergoes definite physiologic changes which on the biologic principles of adaptation are directed toward the expulsion of the products of conception at term. In the non pregnant uterus, Aschoff's anatomic division is useful in its application to the physiologic changes that occur in pregnancy. He holds that in the non pregnant uterus, a narrow portion, the isthmus uteri, usually separates the uterine cavity from the cervical canal. He proposed to call the upper opening of the isthmus uteri the *anatomic os internum*, and the lower opening the *histologic* or the *true os internum*, the intervening structure becoming the lower uterine segment during pregnancy and parturition. The *anatomic os internum* would therefore, correspond to the retraction ring of Barbour and Lusk, contraction ring of Schroeder, or what we prefer to call the "fundal ring" or the physiologic retraction ring, on biologic grounds (35). The portion of the uterus above this physiologic retraction ring

is referred to as the upper uterine segment during pregnancy and parturition

The first response of the uterus after the nidation of the fertilized ovum is hypertrophy, and some hyperplasia of its muscular fibers. This brings about an enlargement of the uterus which is greater than the demand of the growing ovum in the first trimester of pregnancy. This hypertrophy is due to humoral factors. From the fourth month of pregnancy to term, the products of conception are in contact with the walls of the uterine cavity (24), so that the enlargement of the uterus may be brought about either mechanically by the growing fetus (13, 21, 22, 27, 39, 41), or chemically by humoral factors (6, 7, 10, 37), or a combination of both (12, 13, 26, 28). The hypertrophy of the uterine musculature involves obviously the musculature of the entire uterus. These structural changes in the uterus are associated with certain definite adaptive readjustments which manifest themselves prior to, and during parturition. This consists in the development of the two physiologically different segments. These segments have been designated as the upper and the lower uterine segments during the formative periods of the uterus in pregnancy and during parturition. The division of the uterus into an upper and lower uterine segment is an essential process for parturition because one observes an "anatomic" and functional difference between these parts of the uterus during the different stages of labor. The functional differentiation can be demonstrated by a comparative study of parturition in the dog, rabbit, and sheep (34), and in the monkey (19), and is generally recognized among obstetricians. This functional differentiation of the uterus in all species is dependent upon the physiologic properties of the muscular fibers of the upper and lower uterine segments.

The usual obstetric terms used to describe the muscular activity of the uterus are as follows. The upper uterine segment is the active segment, and its muscular changes during parturition consist of contraction and retraction or thickening, or "capping." The lower uterine segment is the so-called passive segment, and its muscular changes during parturition consist of relaxation, stretching, or thinning.

At this point, it is necessary to describe certain phenomena characteristic of muscle activity. First, it must be remembered that the processes of contraction and relaxation are not instantaneous, but occur gradually. Second, when the contracting muscle is permitted to shorten and raise a weight, the contraction is said to be *isotonic*, because the tension on the muscle remains constant during the process of contraction and relaxation. Third, when a muscle is acting on a weight which it cannot move, the muscle does not shorten appreciably. The tension exerted by the muscle increases to a maximum and then declines. Such a contraction is said to be *isometric*. Fourth, a contraction may be *isometric* for a portion of its period and *isotonic* during the remainder, or vice versa. Fifth, when a contraction occurs against a gradually increasing resistance, but still moves an object, the contraction is said to be *auxotonic*. For example, the ventricles of the heart contract *isometrically* until the aortic valves open, and then contract *auxotomically* until the systolic height is reached. In general, the length of the *isometric period* depends on the aortic pressure. The contractions of the uterine musculature in labor are obviously chiefly isometric and auxotonic in type. Sixth, *tone*, or *tonus*, is a term that has been used since the time of Galen and has numerous connotations. Some physiologists think the term should be discarded, particularly when considering cardiac and skeletal muscle. *Tone*, as applied to *smooth muscle*, is generally defined as a *state of sustained contraction* (due to persistent excitation) which varies in duration and degree, and, though modified by, is usually maintained independent of, extrinsic nerve centers. The degree of tone is determined by the resistance to extension. If *tone* becomes very marked and persistent and produces abnormal tension or pressure effects, it is referred to as *spasm*. The terms *hypertonus*, *tetany*, and *spasm* imply not only a sustained shortening of smooth muscle but also increased tension or rise in pressure within a hollow viscus, or that portion of the viscus affected. *But the smooth muscle of a hollow organ may shorten and manifest sustained shortening without an increase in luminal pressure, provided there is a proportional*

decrease in the volume of its contents It is well known that the stomach, intestines, colon, urinary bladder, and uterus may adjust their musculature so that widely different volumes are accommodated without a change in pressure. Thus we must either dismiss the connotation of "tension" from our idea of tonus, or avoid using the term in speaking of such reactions in viscera. This type of tone has been called "postural tone." The sustained shortening of muscle fibers which leads to a postural change has been called a *postural contraction* (Sherrington), and a sustained lengthening has been referred to as *postural relaxation*. The term *postural tone* as applied to the uterus is useful in that the shape, contour, and posture of the uterus depends primarily on the anatomic arrangement and the relative fixation of length (*metrostasis*) of its muscle fibers. The term "postural tone" is also useful in explaining the fact that in labor and after the third stage of labor the uterus tends to assume its original flattened form. The concept is also useful in appreciating how in the presence of normal anatomic development but in the absence of a normally functioning co-ordinating mechanism, changes in contour or shape may result from an imbalance or a disturbance of the postural adjustment of the muscle fibers in different parts of the uterus. But the terms "postural contraction" and "postural relaxation" do not adequately describe in the case of the uterus in labor, the change that occurs in the muscle fibers during the process of thickening of the upper uterine segment and the dilation and effacement of the cervix. Neither do these terms describe the changes that the muscle fibers undergo in the process of producing the changes in shape or posture of the uterus in labor. These changes in the individual muscle fibers are changes in length which become relatively fixed. Whether fixed at an increased length or decreased length the tension is approximately the same.

"*Metrostasis*" is a term that may be used to designate a relative fixation of length without a change in tension. The term does not designate the direction of the change in length. To denote a fixation of length without a change in tension and at the same time denote the direction of the changes in length, two terms

are necessary. We suggest and shall use the term "*brachystatic contraction*" (*brachystasis*, meaning a relative fixation at shorter length) to denote the process in which the muscle after contracting does not relax to its original length and becomes relatively fixed at a shorter length and in which state it manifests the same tension. The term "*metcystatic contraction*" will be used to denote the process in which the muscle relaxes or elongates and becomes relatively fixed at an increased length and in which state it manifests the same tension. Thus, when the urinary bladder, which we shall say contains 400 cubic centimeters of urine at a pressure of 10 centimeters of water, expels a portion of the urine, we shall say 200 cubic centimeters, and then the flow is cut off before evacuation is complete, and after a short time the muscle adjusts itself to the new volume so that the pressure is again about 10 centimeters of water pressure, we may say that the bladder muscle has undergone a *metrostatic* adjustment, or denoting the direction of change in length in this case a *brachystatic* adjustment. During the first and second stage of labor, the upper uterine segment normally becomes thicker due to a sustained shortening or *brachystasis* of its muscle fibers. A successive increase in *brachystasis* results, leading to the phenomenon of "retraction." Conversely, the lower uterine segment becomes somewhat thinner due to a gradual increase in length or *metcystasis* of its muscle fibers. In other words the muscle fibers of the upper uterine segment manifest *brachystatic contraction*, and of the cervix and the lower uterine segment, *metcystatic relaxation* the intra uterine pressure remaining approximately the same during the interval between the easily detected "uterine contractions" or "uterine pains." The term "retraction" describes what occurs in the upper uterine segment as a whole and is a useful term. But the term "retractile tone" is not descriptive of the change occurring in the individual muscle fiber.

To state that the retraction of the upper uterine segment is due to *brachystatic shortening* or contraction of its muscle fibers is a more exact and descriptive statement. *Brachystasis* as manifested by the smooth muscle

of most hollow viscera is more or less temporary. In the uterus, however, it is normally relatively permanent, in that after birth of the products of conception, the uterus remains in a brachystatic state (or a "retracted state")

All muscle fibers in a portion of the uterus or in different layers may not manifest the same degree of brachystasis. For example, in the dog after the lowermost ampulla has been evacuated, the brachystasis of the longitudinal muscle fibers persists, but the circular fibers manifest mecystasis so that the next fetus may descend through the evacuated ampulla.

Another fact of muscle physiology, which is applicable to the smooth muscle of the uterus as observed obstetrically, is that the *power of developing tension is lost as the result of shortening* (Starling's law of the heart: the energy of contraction is a function of the length of the muscle fibers) (38). For example, when the fetal head becomes arrested in the pelvis and the contractions of the uterus continue so that the retraction or brachystasis of the upper uterine segment becomes very marked, the contractions of the upper uterine segment produce less tension than they were capable of, producing before they had undergone such marked shortening. Another generalization of muscle physiology is the smaller the shortening permitted, the greater the tension developed and the longer the duration of the response. We do not know whether this is applicable to the uterus or not, but it probably is.

The phenomenon of smooth muscle, which permits a relative fixation at different lengths and in which state it may still contract and relax has been compared to a ratchet mechanism. The mechanism by which a sustained relatively fixed increase or decrease in length of the muscle fiber is maintained is not known. It is known, however, that this state of sustained fixation of length does not lead to an appreciable increase in the expenditure of energy, or in metabolism, and is relatively indefatigable. Oxygen is necessary to maintain the brachystasis of smooth muscle, but the oxygen consumption during brachystasis is less than during the relaxed state (Evans, 38). This fact has suggested the idea that this economic phenomenon may be due to a change in the physical state of the muscle plasm, it being supposed

that some part or all of the muscle plasm becomes less fluid or more gelatinous. The consideration of these statements obviously has an important bearing on the problem of so called uterine exhaustion and inertia.

Summarizing, it is known that smooth muscle, besides contracting isotonically, isometrically, and auxotonically, is able through the phenomenon of metrostasis, or of brachystasis and of mecystasis, to maintain itself economically at different lengths while exerting the same tension. It is through the manifestation of brachystasis and mecystasis by the smooth muscle of a hollow viscus that the viscus may adapt itself to different contents and manifest differences in form or posture without changes in intravisceral tension. In the case of the uterus, the upper uterine segment thickens by contracting brachystatically and the lower uterine segment thins and the cervix dilates by relaxing mecystatically in a co-ordinated manner to bring about the physiological purpose of uterine contractions, namely, the expulsion of the products of conception from the uterus.

The object of the remainder of this paper is to apply these terms, or concepts, to the muscular changes which occur in the uterus prior to, during, and after, labor.

General remarks Because of hydrostatic principles, it is unlikely that a true isotonic contraction ever occurs in the uterus, especially as long as the "bag of waters" is intact, because it is difficult to imagine a contraction occurring without an increase in tension in the uterine cavity. While the head or body is being born, it is possible for an isotonic contraction to occur for a brief period during the final contraction leading to the birth of these parts. For example, as the trunk is being born there is a brief period during which the rate of shortening of the uterine muscle follows the rate of descent of the trunk so that the tension exerted remains the same.

BRAXTON-HICKS INTERMITTENT UTERINE CONTRACTIONS

Graphic records of the intermittent uterine contractions during pregnancy (36th week) have been made by Bourne and Bell in one patient. The contractions were quite similar

to those observed during the early stage of labor. During a Braxton Hicks contraction, the contraction occurs against a gradually increasing intra uterine pressure until a plateau is reached when the contraction for a brief period continues without a change in pressure and length and then relaxation results. They may be compared to the rhythmic contractions of the distended urinary bladder. They are chiefly isometric in character in the sense that nothing is moved, no physical work is performed, and that only the tension exerted by the muscle on the contents is increased.

During labor First stage With the onset of labor, the muscle fibers of the upper uterine segment contract auxotomically until such resistance is met that appreciable shortening of the fibers does not occur. Then the contraction becomes isometric, nothing is moved. Then relaxation occurs, but the muscle fibers do not return to their original length, or in other words, the muscle fibers manifest brachystasis. (As in true hunger pains, the pain of vigorous uterine contractions is experienced after the contraction is well under way and may persist for a short time after relaxation, or the return to the original intra uterine pressure.) The records of Schatz, Bourne and Burn, and Moir show that after relaxation has occurred the intra uterine pressure returns to its original level. Since as the contractions continue it is known that the upper uterine segment thickens and the cervix is effaced and since the intra uterine pressure between contractions returns to "normal" the brachystatic contraction of the upper uterine segment bears a reciprocal relationship to the mecystatic relaxation of the cervix and the lower uterine segment. That is, during the first stage, the upper uterine segment retracts 'only to the extent that the cervix and lower uterine segment "gives" or relaxes. (One must recall at this point that a mecystatically relaxed muscle still manifests "tone," still resists stretch, and that it may contract on stimulation. It has only increased in length in a ratchet like manner. A muscle in a mecystatic or brachystatic state may be stretched mechanically as may occur in the "version procedure" for example but if stretched suddenly, injury results. Some would say that injury should always result

Sufficient study has not been made to warrant an absolute statement on this point. This does not mean that the state of brachystasis or mecystasis cannot be reversed. Such reversal occurs in the stomach, intestine, and urinary bladder.) The function of the contractions during the first stage is to efface and dilate the cervix. None or but little descent of the presenting part occurs. Descent is a feature of the second stage.

Second stage of labor Mecystatic relaxation of the lower uterine segment and cervix does not occur during the second stage because dilation of the cervix has been completed. Thus after the end of the first stage the uterus manifests only contraction and brachystasis. The attachments of the uterovaginal canal have been pulled taut and are kept taut by the brachystasis of the upper uterine segment. Further the intra uterine pressure between the contractions is somewhat higher than during the first stage. This means that some "incomplete tetany" or spasm is present. This may be a normal or an abnormal phenomenon, since it is shown in the records of Schatz, but not in those of Bourne and Burn until they gave pituitrin. (Here again we have an analogy to hunger contractions in the stomach. As a hunger period progresses, the intragastric tension manifested between the individual hunger contractions is increased until finally the hunger period is usually ended by a brief period of gastric tetany or spasm.) Before one may state definitely that the incomplete tetanus of the uterus shown by Schatz tracings is a normal phenomenon, more records than those available will be required.

During the second stage of labor the brachystatic contraction of the upper uterine segment becomes more and more marked as the fetus descends. (In the stomach, brachystatic contraction of the muscle of the fundus becomes progressively greater as the fundus empties.) With the cervix fully dilated, lever action of the lower muscular pole of the uterus working against the head is gone and the "pull" of the uterine contraction is now exerted primarily on the attachments of the vaginal canal. Obviously, after effacement and dilatation are complete mecystatic relaxation of the lower uterine segment should and

does not normally occur, the muscle fibers should not elongate, but should hold stationary until the upper uterine segment expels the fetus from its lumen. Then the lower uterine segment should contract to a certain extent to expel the hind parts of the fetus, which actually occurs, according to direct observation in the dog, rabbit, and monkey.

Obstetrically, in the second stage of labor, the following sequence of events is observed: the contraction is observed to start; after a few seconds, the head begins to descend, then the descent practically ceases, though the contraction persists, as the contraction disappears, the head rises slightly. This may be interpreted to mean that the uterus first contracts isometrically (the head does not descend), and after a certain tension is reached, the head begins to descend, so that the contraction is now auxotonic (head descends against increasing resistance), then, the tension becomes insufficient to overcome appreciably the resistance and the contraction is isometric, then, the uterus relaxes and the head ascends slightly, but the head does not return to its original position because brachystasis occurs in the upper uterine segment.

The apparent temporary uterine arrest which follows the birth of the head for a brief period, probably indicates that several contractions of the uterus must occur, or some time must elapse, to permit sufficient brachystatic contraction to result to bring the uterine musculature firmly against the hind parts, and again to pull taut the uterovaginal attachments. That this is in part true is indicated by the fact that, after the birth of the head, the cervix becomes smaller, contracting about the neck, and then dilates again about the shoulders as the evident contractions start. Or, the apparent inertia may be due to what physiologists (17) call an "incomplete tetanus," slow relaxation, or a "contraction remainder." According to our observations (34, 35) on the dog both factors are concerned and a true inertia does not exist at this time. This temporary apparent "inertia" is probably analogous to the usually more prolonged "inertia" that follows the second stage.

The erection, or anterior movement, that the uterus undergoes during each contraction

is due to the fact that associated with the formation of the lower uterine segment and the effacement and dilatation of the cervix, the structures of the posterior vaginal canal "give" more. The manifestation of this phenomenon is primarily dependent on the greater relative fixation of the anterior lip than the posterior lip of the cervix. It is not reasonable to believe, in view of the obstetrical facts, that the anterior uterine muscle is stronger than the posterior (33).

As dilatation of the cervix is the important criterion of the efficiency of the uterus in the first stage, the descent of the head is obviously the important criterion of the expulsive efficiency of the uterus during the second stage. The amount of descent with each uterine contraction is the resultant of the expulsive efficiency of the contraction and the resistance offered by the structures of the birth canal (vagina and pelvic diaphragm), because opposing forces are concerned. The upper uterine segment as a co-ordinated unit must contract first auxotonically and then isometrically in order to dilate the birth canal. If the isometric, or plateau, period of the contraction is of short duration, the dilating efficiency of the contraction is reduced. After the contraction, brachystasis of the fibers of the upper uterine segment, as a unit, must result to conserve the advantage gained. *Without brachystasis sustained descent is impossible.* If brachystasis is not normal, descent will occur slowly, because the efficiency of the subsequent contraction is reduced. In the instance that the fetal head meets with unalterable resistance due to pelvic disproportion, for example, and the upper uterine segment manifests normal contractions and brachystasis, the lower uterine segment having "less musculature" becomes excessively thinned and the upper uterine segment excessively "capped" or retracted. And, the normal physiologic retraction ring (contraction ring of Schroeder or retraction ring of Barbour and Lusk) found at the junction of the upper and lower uterine segment will be converted into a pathologic retraction ring (Bandl's ring).

Third stage of labor. After the delivery of the child, the upper uterine segment usually undergoes, both longitudinally and circularly, a marked "tetanic contraction" plus brachy-

static contraction, which must inevitably result in a separation of the placenta, or the greater part of it, if not all, and in the formation of the retroplacental hematoma. Several contractions may be required, however, to bring about the degree of brachystasis (retraction) necessary to separate the placenta and membranes completely and to close the maternal sinuses. The lower uterine segment which had contracted isotonically or auxotonically as the breech was expelled, relaxes to receive the placenta.

A period is sometimes observed between the birth of the child and the separation of the placenta during which the uterus is firm and does not contract and relax and appears to be in a fixed state in regard to motility. Or, after the placenta has been separated from the upper uterine segment and is present in the lower, the same phenomenon may be observed in the upper uterine segment. Such sustained contractions when they occur in other hollow viscera are referred to as spasm or "incomplete tetanus" preferably the latter. The intact uterus of the dog, monkey, and man (19) manifest the same phenomenon temporarily (2 to 10 minutes) after a dose of pituitrin following which the uterus again contracts auxotonically, gradually relaxing after each contraction until the original intra uterine pressure is reached. By analogy with the stomach in hunger in which a vigorous hunger period is completed by the evidence of spasm or tetany (also the irritable urinary bladder), one should regard this phenomenon as due to a temporary spasm or incomplete tetanus.

After this period of incomplete tetanus, the upper uterine segment relaxes and its cavity is filled with blood. After a period of inertia, or rest which varies considerably in length, normally auxotonic contractions appear which expel the placenta and blood, and the uterus becomes temporarily a pelvic organ. Later the uterus relaxes and becomes an abdominal organ, the fundus rising to the level of the umbilicus.

In the dog brachystasis is evidenced more markedly by the longitudinal than the circular muscle and it is certain that the separation of the placenta is caused, and bleeding from the

placental site is controlled, to a much greater extent by brachystasis of the longitudinal than of the circular muscle fibers. In the monkey, brachystasis is as marked in the lower as in the upper uterine segment and all the muscle fibers appear to be concerned in the separation of the placenta and the control of bleeding from the placental site. In a cesarean section, as soon as the child is delivered, the whole uterus contracts as may be seen and felt, but in a few minutes the lower uterine segment becomes quite flaccid in contrast to the upper uterine segment which remains firm for a longer but variable period. The lower uterine segment manifests considerable brachystasis as is shown by the fact that it is thicker than it was prior to delivery. The brachystasis of the lower uterine segment is not as marked, apparently, as that which occurs in the upper uterine segment and is not as marked in the human under anesthesia as in the monkey.

After the birth of the placenta under normal conditions the brachystasis or "retraction" particularly of the upper uterine segment is practically maximal. In spite of the high grade brachystasis it contracts and relaxes rhythmically. This is not only true of the dog and monkey (19, 34) but also of the human (4) the graphic records obtained from the dog and monkey being quite identical to those obtained from the human postpartum uterus (8). These contractions are auxotonic in type rising from a pressure of zero or 'the baseline pressure' which depends on the amount of air or water in the balloon to a pressure which may vary from 5 to 50 millimeters of mercury (human) depending on the animal studied.

DISCUSSION

From the foregoing review, it is evident that uterine muscle manifests primarily four different types of activity during labor, namely, auxotonic and isometric contractions and brachystatic contraction and mystatic relaxation. One type of activity is as important for parturition as any other. The auxotonic and isometric contractions are responsible for the production of the force that expels the fetus downward. But without brachystatic contraction to take up the "slack," to hold the advantage gained, and to maintain the uterine

musculature in firm contact with the breach, much of the directed force of the auxotonic and isometric contractions would be lost. Without mecystatic relaxation, i.e., if after each uterine contraction, the musculature of the cervix did not normally relax or elongate to a greater extent than existed before the uterine contraction, excessive force would have to be applied by the upper uterine segment to produce effacement and dilatation of the cervix; and further, if the musculature of the cervix and the lower uterine segment after relaxing or elongating, did not become relatively fixed at an increased length at which it exerted the same tension, the lower uterine segment and cervix would become more rapidly and excessively thinned and dilated by the contractions of the upper segment. Or, in other words, the effacement and dilatation of the cervix uteri is not a mechanical stretching process pure and simple, like stretching so much rubber, but is a true physiologic phenomenon.

In auxotonic and isometric contraction, physical work is performed and energy-producing substances are required. Hence, this type of uterine activity is subject to fatigue or exhaustion. Brachystasis is not only economical in that it conserves the force of the uterine contractions by causing them to be applied most advantageously but, also, in that it does not require an appreciable expenditure of energy for its maintenance and is relatively indefatigable. A consideration of these statements has an important bearing on the problem of uterine exhaustion and inertia uteri and much progress is not to be expected in this field until more is known concerning the metabolism of uterine muscle.

It is entirely possible for smooth muscle to manifest auxotonic and isometric contractions without manifesting brachystatic contraction. The obstetrician sees patients in whom the uterine contractions are fairly strong, but in whom no "capping" or thickening of the upper uterine segment occurs. One of the problems in obstetrics is to find a drug or procedure that will stimulate the three types of activity manifested by the upper uterine segment in labor without at the same time interfering with the mecystatic relaxation of the lower uterine segment and cervix or causing localized

spasm. Pituitrin and ergot both augment the auxotonic and isometric contractions of the uterus, and may possibly promote brachystasis, for varying periods depending on the dosage and sensitivity of the uterus, but unfortunately, both of these drugs affect the lower uterine segment as much as the upper. This statement, of course, is only relatively true because the upper uterine segment is more powerful. But one can never feel certain that "incomplete tetanus" or tetanus, localized or general, might not occur. A rational therapy for *adynamic uterine inertia* will not be available until we learn more of the fundamental physiology of the uterine musculature.

We do possess two agents which depress or inhibit uterine contractions, namely, ether and epinephrine. The inhibiting action of epinephrine on the uterus *in situ* of the dog and monkey has been graphically demonstrated by Rudolph and Ivy (34) and by Ivy, Hartmann, and Koff (19), and of the human by the work of Bourne and Burn (4), and Rucker (31). Further studies on magnesium and calcium are needed (see Blair-Bell, Datnow and Jeffcoate, (2). But we believe that the problem of *hypertonic uterine dyskinesia* (ill motion) is not solved and awaits the acquisition of further knowledge pertaining to the fundamental physiology of the uterine musculature.

On the basis of general physiologic considerations, the factors concerned in the cause of uterine dysfunction or uterine dyskinesia during labor may be analyzed as follows. First, the *extrinsic factors* which operate (a) either through the nerves (nervous) leaving the lumbosacral region or (b) the blood (humoral). Among the nervous influences, fear and anxiety may lead to a hyperkinetic cervix, or an increase in tension of the muscles of the pelvis, or produce an inco-ordination of the power and the harmonious sequence of the activity of the uterine musculature. A direct example of a spino-uterine reflex is the mammo-uterine, or "nipple" reflex. Among the humoral influences that must be thought of are: (a) a disturbance of the excitatory (hormone) and inhibitory (chalone) autacoids (self-remedial substances; internal secretions) that may be concerned in the initiation and progress of labor, as well as the normal development and

differentiation, or the quantitative and qualitative irritability of the gravid uterus (2, 20, 25, 29, 30), (b) changes in the composition of the blood which affect the irritability and contractility of muscle, regardless of the type of muscle, and which occur in such conditions as physical exhaustion, infections or toxemias, starvation, "shock," and changes in functional mineral balances. Second, the *intrinsic factors*, which involve (a) qualitative and quantitative disturbance of the muscle fibers due to local disease or abnormal differentiation of the muscle cells due to other factors than extrinsic factors, and (b) disturbances of the intrinsic co-ordinating mechanism. We hesitate to indicate whether the uterine contractions initiated by rupturing the membranes, a bag, or pulling down a leg are due to an intrinsic uterine reflex, or to a spinal reflex. We are inclined to the view on the basis of our animal experiments and the discussions in the literature, that both an intrinsic and an extrinsic reflex mechanism are concerned.

The possible functional types of uterine motor dysfunction, or uterine dyskinesia, which may theoretically occur are suggested in the following outline:

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- I Hypokinetic uterine dyskinesia, so called uterine inertia
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- II Hyperkinetic uterine dyskinesia
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 - b Amecystatic failure of the muscle fibers of the lower uterine segment to relax and become relatively fixed at an increased length. This would produce the picture of a spastic or hyperkinetic lower uterine segment and cervix uteri.
 - c Constriction rings occur most likely at points which have sphincter like properties such as (a) cervix (b) fundal ring or the physio-

logic retraction ring (c) at the phylogenetic constriction zones (32)

III Arrhythmia

- a Asynchrony of the pace maker of the uterus
- b Unilateral inertia of the pace maker of the uterus
- c Sacculation—(localized paresis) (that is not due to organic defects)
- d Ectopic contractions (has not been reported)
- e Reversed polarity Webster Galabin and Blacker

The well recognized example of hypotonia or adynamic type of uterine dyskinesia is primary or secondary uterine inertia. The contractions are weak and irregular, of short duration, or absent, or very infrequent. When they are weak and of short duration, the isometric phase of contraction is absent, and brachystasis is poor or absent. Bourne and Bell, who made graphic records of the weak irregular contractions in a case of uterine inertia, describe their records as follows: "It will be noted that the contractions are irregular in force and frequency, and they have pointed apices (absence of isometric phase) indicating a short, snappy effort, during which the uterus does not hold on to its work."

The failure of the muscle fibers of the upper uterine segment to manifest brachystasis—abrachystasis—should be recognized as one type of uterine dyskinesia, because it is possible for a smooth muscle fiber to contract and relax to its original length and not manifest brachystasis. Some additional factor or type of stimulus, other than that required to produce contraction, must be present in order to produce brachystasis. What this factor is in the case of smooth muscle is not known. (In the case of skeletal muscle, it appears to depend on the frequency of the nerve impulse originating in the anterior horn cells of the spinal cord—14). Whatever the factor that causes brachystasis may be, it is known that it is absent during the Braxton Hicks intermittent uterine contractions, except during the last month of pregnancy when the formation of the lower uterine segment is evident (33). Hence during labor this factor may be inhibited or totally suppressed and contractions may occur without progress being made, even in the presence of a dilated or a normally dilatable cervix.

From the viewpoint of the comparative physiology of the uterus, one might predict that the parts of the uterus to be affected most commonly by circular spasm or hypertonus would be those regions in which the circular fibers have "sphincter-like" properties. This, of course, is borne out clinically, because in the human, as the literature demonstrates, intra-uterine rings are found in different regions from the internal os to the fundus uteri. Bumm's frozen section of the third stage of labor (5) shows these rings to be present in the uterine cavity at different levels from the external os to the fundus uteri. Just as sphincter hypertonus or spasm leads to abnormal motor activity and evacuation in other hollow viscera, the same is true of the uterus. One might predict that the part of the uterus to manifest spasm or hypertonus most commonly would be the cervix (cervical sphincter in the dog and monkey) and the physiologic retraction ring (fundal sphincter in the dog) or the site of junction of the upper and lower uterine segments (32). This, of course, is true clinically of the human uterus. As is true of abnormal motor states of other hollow viscera, constriction rings may occur at almost any point, or the entire musculature of the viscus may manifest spasm or a spastic tendency.

Since a co-ordinating mechanism undoubtedly exists in the uterus (35) and "pace-makers" are probably present (19), various types of inco-ordination may result. The "pace-makers" may discharge synchronously, or either one or both may not act at all, or a functional block in the co-ordinating mechanism may occur, or, because of some change in the irritability or refractory period, the circular, longitudinal, and oblique muscles may not contract synchronously (called arrhythmia-colic uterus—by Dutta). Or, ectopic contractions may occur. We (35) have ascribed certain types of obliquity and sacculaton to a disturbance of the co-ordinating mechanism—those types of obliquity which respond rather quickly to therapeutic procedures and in which a fundamental defect in the musculature could not have been the fault. Undoubtedly in the other types of uterine dyskinesia the co-ordinating mechanism may be involved either on the basis of cause or effect.

SUMMARY

In this paper we have tried to emphasize the time honored concept that uterine "retraction" and "contraction" are two distinct processes both of which are necessary for the evacuation of the uterus. "Retraction," in the first stage of labor, leads primarily to a readjustment of the muscle fibers of the uterus whereby the uterus prepares itself for evacuation, and in the second stage, maintains the uterine musculature in firm contact with the breech without a significant change in intra-uterine tension. "Retraction" is an economical and a relatively non-energy consuming process, whereas, "contraction" is an energy-consuming process. In introducing the term "brachystasis" or "brachystatic contraction," we have in mind a more exact term which describes the change which the muscle fibers undergo in order to manifest the phenomenon of "retraction." In addition, we have introduced the term "mecystasis" or "mecystatic relaxation" to describe more accurately, we believe, the change that the muscle fibers of the cervix and the lower uterine segment manifest primarily during the first stage of labor, although a certain degree of "mecystatic relaxation" of the lower uterine segment undoubtedly occurs during the latter months of pregnancy and in part explains the phenomenon of "lightening," and during the third stage of labor after the separation of the placenta and before its expulsion.

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THE SURGICAL ANATOMY OF THE SUPERIOR HYPOGASTRIC PLEXUS—"PRE-SACRAL NERVE"

JOHN S. LABATE, B.S., M.D., New York, New York

THE superior hypogastric plexus first attracted surgical attention in 1924, when Cotte practiced its resection for the relief of pelvic pain.

Frankenhaeuser, in 1867, had published a detailed account of the nerve supply to the female pelvic organs. He described large plexuses in the broad ligaments that consist of fibers from the hypogastric as well as from the sacral plexuses. He subdivided the hypogastric plexus into an inferior hypogastric plexus and a "plexus uterinus magnus," the latter of which is now known as the superior hypogastric plexus. Latarjet and Bonnet (1913) considered the plexus a single nerve trunk to which they gave the name "presacral nerve." Numbers of other investigators have since contributed to the knowledge of the anatomy of this plexus, among them, in Europe, Morrisson-Lacombe (1920), Roussel (1926), Segond (1926), Delmas and Laux (1927), Hovelacque (1927), Bergier (1930), Chianello (1930), Elaut (1932), Fontaine and Herrmann (1932), Davis (1934) and Dobrzaniecki and Serafin (1934) and, in the United States, Learmonth (1931), Douglass (1934), and Kindel (1935).

Prior to Cotte's practice of resection of the superior hypogastric plexus for the relief of pelvic pain, periaarterial sympathectomy of the hypogastric and common iliac arteries was the popular procedure. After 1925 Cotte's simpler operation became the operation of choice. Today resection of the superior hypogastric plexus is employed in any of the following:

- A. In patients with no demonstrable pathological changes in the pelvis
 1. Intractable functional dysmenorrhea (Cotte, Fontaine and Herrmann, Leriche, Elaut, Cannaday, Abbott, Adson and Masson, Keene, Counsellor and Craig, Wetherell and others).

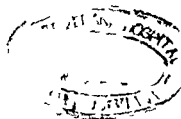
From the Obstetrical and Gynecological Service (Third Division), The Laboratories of Pathology, Bellevue Hospital, and The Department of Obstetrics and Gynecology, The Department of Anatomy, Graduate School New York University

- B. In patients with slight pathological changes in the pelvis
 1. Persistent pelvic pain following previous operations (Fontaine and Herrmann, Pemberton)
 2. Sclerocystic degeneration of the ovaries (Fontaine and Herrmann, Lhermitte and Dupont, Cotte)
- C. In patients with advanced pathological changes in the pelvis
 1. Inoperable carcinoma of pelvic organs (Greenhill and Schmitz, Behney, Jianu, Fontaine and Herrmann, Pemberton).
- D. Disorders of the lower genital tract
 1. Pruritis vulvæ (Leriche, Cotte, Simon, Cottalorda and Gavaudan).
 2. Vaginism (Jaboulay, Olivier).
 3. Dyspareunia (Jaboulay, Tassovatz)
- E. Various disorders of the urinary bladder.
 1. "Cord bladder" (Learmonth, Fulcher, Cannaday)
 2. Spasm of bladder neck (Douglass, Learmonth)
 3. Intractable cystalgia (Douglass, Learmonth, Rochet, Pieri)
- F. In patients with disorders of function of lower bowel.
 1. Hirschsprung's disease (Abbott)
 2. Obstipation of rectal origin (Abbott, Wetherell)

METHOD OF STUDY

Dissections were made first on the cat and rabbit to obtain practical knowledge of the sympathetic nervous system. Later, through the courtesy of Professor G. J. Noback, a series of six human dissections was made in the anatomical laboratories of the Graduate School of New York University. In each case the entire abdominal sympathetic nervous system was exposed. Casts were made at various stages of the dissection by employing the method devised by I. Rehman and G. J. Noback. The final cast was a composite of the aortic plexus, the superior hypogastric plexus, the ovarian and renal plexuses, and the lumbar sympathetic trunks (Fig. 6). The exact communications of the abdominal sympathetic plexuses with the main ganglionated sympathetic trunk were studied, trac-

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THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

FOR a great many years Sauerbruch's *Die Chirurgie der Brustorgane* has been the principal deposit of the lore of thoracic surgery. Whoever was familiar with the language and had access to the volumes could consult them with the assurance of a profitable return. The normal obsolescence to which all textbooks are subject was compensated for by good historical surveys and extensive reference to the accumulated literature. The price of the book was greater than many felt they could afford and the barrier of language stood in the way of many others. For these reasons the idea of an English translation has occurred to many.

*Thoracic Surgery*¹ by Sauerbruch and O'Shaughnessy is a condensation and modernization of Sauerbruch's original work. The condensation has sacrificed considerable that made the older work permanently valuable and the modernization has not been as complete as one might wish. This is particularly evident in the section on the collapse therapy of pulmonary tuberculosis, the discussion of indications is hurried and dogmatic and that of technique not abreast with current practice in other clinics. A great number of the improvements in thoracoplasty which have been so successful in lowering the mortality and increasing the percentage of clinical cures are not mentioned. This is true of the current practice of removing the full lengths of the upper ribs, it is true of Semb's apicolysis and of the practice of removing or sectioning the costal cartilages. In these important respects the book is not adequate and should not be trusted as a guide to present practice.

There is scarcely anyone who has so impressed himself upon a field of surgery as has Ferdinand Sauerbruch. His name is now, and for many years to come will be, almost daily upon the tongues of all who do thoracic surgery. From 1907 and 1908, when, as Fredreich's assistant, he helped to carry out Brauer's important ideas on collapse of the lung, he has interested himself chiefly in surgery of the chest. Both as a contributor and a popularizer he has led and dominated the field. While most of the important discoveries have been made by other men they were able to do so only because Sauerbruch had opened up the field.

JEROME R. HEAD

RECENTLY Edward C. Brenner has written quite an extensive volume,² covering 843 pages and designed to serve as a textbook for those inter-

¹THORACIC SURGERY. A revised and abridged edition of Sauerbruch's *DIE CHIRURGIE DER BRUSTORGANE*. By Ferdinand Sauerbruch and Laurence O'Shaughnessy, F.R.C.S. Baltimore: William Wood & Co., 1937.

²PEDIATRIC SURGERY. By Edward C. Brenner, A.B., M.D., F.A.C.S. Philadelphia: Lea & Febiger, 1938.

ested in the practical side of the field of surgery in children. It accomplishes its objective very well, I think, but it does omit any discussions of fractures, dislocations, and other orthopedic conditions. Special emphasis has been placed on pathology, diagnosis, and treatment of every condition discussed, but any reference to the literature, bibliographies, or theoretical discussions have been entirely omitted purposefully by the author. Certain chapters, such as that on blood transfusion, congenital cleft lip and palate, surgery of the chest, urologic conditions, and neurological surgery have been written as special articles by various prominent men. Otherwise the entire text is a product of the author himself. It is very well illustrated by many excellent photographs, clear x-ray prints, and drawings.

After very carefully reviewing this book I cannot help but feel that it is a valuable addition to the list of books covering this field of practice.

EDWIN M. MILLER

DR. CUSHING'S most recent monograph³ on the meningiomas cannot be considered by the ordinary rules of book reviewing. Stamped indelibly with his style, it is more than a mere record of 300 intracranial tumors of a specific type. It tells vividly of the disappointments, the discouraging moments, and the brilliant success in a battle directed by one individual against a group of intracranial tumors the treacherous nature of which ensnares the unwary and often the wise and experienced surgeon. It is colored brightly by the unbroken succession of marks of influence which Harvey Cushing has placed upon the art and science of neurological surgery. It is filled with the unwavering confidence and devotion which his patients throughout the years have shown to his surgical skill and judgment—and to these companions in battle he pays glowing tribute.

Dr. Cushing has often said that the conscientious surgeon should look upon the results of his work much like his golf score—as something against which he must be constantly shooting in an effort to reach par, that the self-discipline of such an attitude rigidly enforced was good for the surgeon's soul. Here then is a record of that game, if you please, played against the meningiomas. Beginning at Johns Hopkins Hospital at a time when neurological surgery was non-existent as a surgical specialty, starting his own surgical career, and without a great deal of encouragement from his seniors for his efforts in a field of surgery which they felt was hopeless and

³MEINGIOMAS, THEIR CLASSIFICATION, REGIONAL BEHAVIOUR, LIFE HISTORY AND SURGICAL END RESULTS. By Harvey Cushing, M.D. With the collaboration of Louise Eisenhardt, M.D. Springfield, Ill. & Baltimore, Md.: Charles C. Thomas, 1935.

ing the fibers from their origin to their ultimate distribution in the female reproductive organs.

Following this detailed preliminary study, observations on the anatomy of the superior hypogastric plexus were made on 69 subjects investigated by necropsy. Thus a total of 75 dissections were done. Twenty three of these were in adults. Fifty two were in infants ranging from 20 to 40 weeks' gestation. There were 38 males and 37 females in this series.

AFFERENT COMPONENTS

The afferent (sensory) fibers probably pursue a course similar to the efferent (motor) nerves with the exception of a detour via the posterior roots to reach the sensory nerve cell in the posterior root ganglion.

The afferent nerves from the ovary travel in the ovarian plexus along the course of the ovarian artery and ultimately reach the spinal cord at the level of the tenth thoracic segment (Kuntz). Recent experimental evidence in the cat (Labate and Reynolds) as applied to the sensory pathways of the ovarian plexus shows:

a. The sensory fibers arise near the various peripheral branches of the ovarian artery and follow its course closely.

b. The afferent fibers enter fourth lumbar sympathetic ganglion, then traverse upward through the third lumbar ganglion to reach a higher level in the main sympathetic trunk.

c. The ovarian afferent components have no connection by way of the superior hypogastric plexus, nor do they traverse the inferior mesenteric ganglia or the lower aortic plexus.

The afferent fibers from the fallopian tube enter the cord at the level of the eleventh thoracic to first lumbar segments (Kuntz). Most of these fibers probably course through the superior hypogastric plexus. Some of the afferent fibers from the tube also pass through the ovarian plexus (Labate and Reynolds).

The afferent fibers from the uterus reach the cord at the level of the tenth thoracic to first lumbar segments (Kuntz). These fibers pass through the superior hypogastric plexus.

MOTOR COMPONENTS OF THE SUPERIOR HYPOGASTRIC PLEXUS

Two or more parallel nerve bundles are arranged over the anterolateral surface of the

aorta, usually one or perhaps two on each side. These are known as the intermesenteric nerves (Petit Dutaillis and Flandrin). They originate from the inferior pole of the celiac plexus at the level of the superior mesenteric artery and descend over the anterolateral surface of the aorta. Below the point of bifurcation of the abdominal aorta into the right and left common iliac arteries, the intermesenteric nerves become the main components of a triangular shaped plexus—the so called superior hypogastric plexus (Figs 1 to 8). This plexus descends for a distance of 6 to 8 centimeters overlying the lumbar vertebrae in the space between the right and left common iliac arteries. Over the middle of the first sacral vertebra the superior hypogastric plexus divides into a right and a left inferior hypogastric nerve (Figs 1, 3, 6). Each of these continues downward to the lateral rectal space where it ends in the inferior hypogastric plexus. From the inferior hypogastric plexus fibers are distributed peripherally to the pelvic viscera (Fig 8).

The intermesenteric nerves, extending over the anterior surface of the abdominal aorta from the origin of the inferior mesenteric artery are connected by numerous anastomoses of nerve fibers, resulting in the formation of the aortic or intermesenteric plexus (Figs 1 to 6). As each intermesenteric nerve descends over the aorta it also receives peripheral rami from the lumbar sympathetic ganglia (Fig 3).

Hovelacque regards the superior hypogastric plexus as a continuation of the mesenteric plexus below the inferior mesenteric artery. Delmas and Laux believe that the important branches to this plexus are derived from the lumbar sympathetic chains and that the fibers from the first and second lumbar ganglia are the principal roots to the intermesenteric plexus. In my dissections of infants the prominence of these fibers was apparent, but in the adult dissections the branches from the lumbar ganglia appeared to be less conspicuous, and it was obvious that the main components of the superior hypogastric plexus were derived from the intermesenteric nerves.

The right intermesenteric nerve crosses the right common iliac artery close to its point of

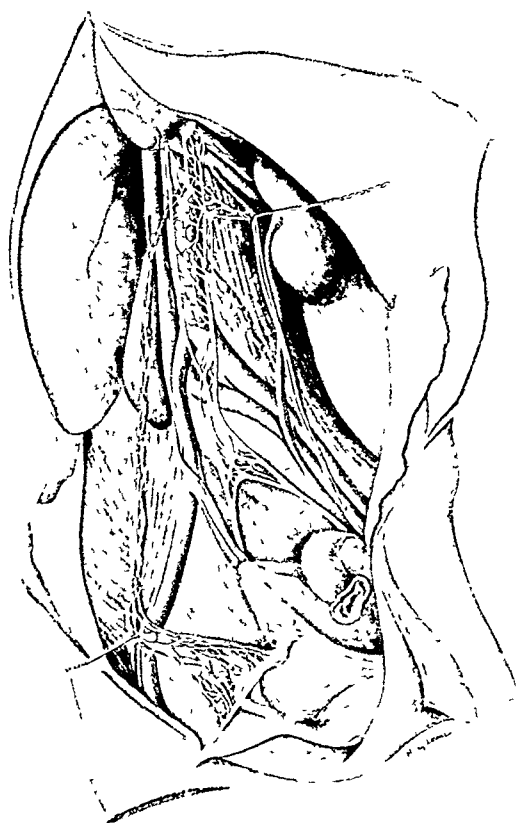


Fig 1 Dissection to show the abdominal sympathetic plexuses. Note the method of formation and triangular structure of the superior hypogastric plexus. The ovarian plexus on the left has been dissected throughout the course of the ovarian artery extending into the infundibulopelvic ligament.

origin from the aorta. The nerve then bends toward the midline and continues downward through the interiliac space overlying the lumbar vertebrae (Figs 1, 6). The left intermesenteric nerve runs beneath the inferior mesenteric artery. As it passes beneath that artery it gives off several branches to the inferior mesenteric plexus. The left intermesenteric nerve then continues inferiorly, crosses the left common iliac vein and runs parallel with, and about one-half to 1 centimeter to the left of, the right intermesenteric nerve (Figs 1, 4, 6). The right and left intermesenteric nerve bundles below the bifurcation of the aorta are connected by oblique anastomoses to form the superior hypogastric plexus.



Fig 2 Dissection showing the abdominal sympathetic plexuses. Here the superior hypogastric plexus is represented by bilateral nerve trunks which descend through the interiliac trigone. Note the density of the aortic (intermesenteric) plexus.

Due to the gradual divergence of the main nerve bundles to terminate in the inferior hypogastric nerves, the shape of the plexus is usually triangular (Figs 1, 4, 6).

In 8 per cent of the present series of 75 dissections, the intermesenteric nerves continued downward below the bifurcation of the aorta in parallel fashion without plexus formation (Figs 2, 12).

In 8 per cent the intermesenteric nerves united below the aortic bifurcation to form a central nerve bundle, which descended through the interiliac trigone.

Rami from the lumbar sympathetic ganglia. Each intermesenteric nerve receives peripheral rami from the lumbar sympathetic ganglia (Fig 3). The ramus from the first lumbar ganglion runs obliquely downward beneath the renal artery to join the intermesenteric

limited, one may read of the struggle against what must have seemed at times to be hopeless odds. The score he has entered is one against which all other neurological surgeons must play.

Meticulously kept records on every patient, the rigid requirement of verification of tumors by microscopic section, operative notes written at the moment and often illustrated to capture a point difficult to describe and, I suspect, many hours of self communion to discover how he might have done better all have combined in these pages to reveal the master surgeon. During his career he has seen the development of more exact and earlier diagnosis in intracranial lesions, the improvement of surgical technique which has made operations upon the brain safe procedures, the lessening of hemorrhage by operations performed under local instead of general anesthesia, the introduction of electrosurgical methods, the classification of tumors into groups and the correlation of their clinical behavior with their microscopic appearance and the training of young surgeons in the art of neurology and the other allied fields necessary for successful accomplishment. In all of these endeavors he has shown the way to those who attempt to follow in his foot steps. One wonders which he considers the most important contribution, but I suspect it was his conception and insistence upon the carefully planned technique of those early operations which successfully laid the ghost of infection, cerebral fungus and ugly mutilating scars. This was *sine qua non*. It is possible of course that many of these contributions may undergo modification in the future and to whom the original credit belongs may be forgotten, but the stimulus and encouragement he has given to the succession of youngsters in this country and abroad who have set their sails under his guidance will always remain his monument.

Written in a charming style, the material and statistics arranged in an interesting manner by Dr Eisenhardt, the book does not need to be read by a neurological surgeon to follow the story with profit to his surgical soul. L. D.

A BOOK that covers well every phase of the work expressed in the subject treated is the work by Cheney on *Diagnosis and Treatment of Diseases of the Stomach and Intestines*.¹

The text is well planned. Dr Cheney has selected the best methods for diagnosing and treating diseases of the stomach and intestines and has presented them briefly but with such definite clearness and enough detail that it should be of much practical value to every physician and surgeon.

The book is divided into two parts. Part I deals with diseases of the stomach and Part II with diseases of the intestines. Preceding each part is a brief discussion on the best methods available for

investigation of patients with stomach trouble and the intestinal diseases.

Each chapter is a complete discussion of the diagnosis and treatment of a certain group of diseases. The cause of the disease, the clinical history of the disease, the physical examination, and the various methods necessary for the diagnosis and treatment of the disease are presented in a most comprehensive manner.

The author has not forgotten the physician who does not have the assistance of the hospital or of a technician and has simplified the laboratory method so that many of them can be carried out by the physician himself.

I strongly recommend this book to every physician and surgeon, and especially to those who are young in the profession. C. J. BARBERA

IN the preface of the book on *Diseases of the Nervous System of Infancy, Childhood, and Adolescence*, Ford states that he has attempted to include all the (neurologic) conditions which occur in childhood and in this difficult task he has succeeded well. However, the number of topics treated (about 400 are listed in the table of contents) has necessitated such economy of expression as to interfere at times with adequate presentation. Indeed, some subjects are given no more than thumbnail description. The pediatrician may find its descriptions too sketchy for the neurologist; it cannot displace the larger texts, monographs and systems to which he is accustomed for the undergraduate; it is insufficiently elementary. However, the usefulness of the work is enhanced by the numerous small bibliographies which for the more interested reader, may serve as an entrée to the literature. HARRY A. TASHIRO

THE comprehensive work on *Pediatric Urology* is unquestionably the best of its kind. It is enhanced by a voluminous bibliography and excellent index. It is profusely illustrated and reveals a wealth of clinical material. Included in the second volume is a section on Bright's disease in infancy and childhood by John D. Lytle. It is a valuable addition by one who has devoted many years to the problem of nephritis in children. This feature, the author justly believes, should be included in all urologic texts. The urologist should be familiar with the medical as well as the surgical diseases of the kidney.

The consideration of anomalies of the genitourinary tract is well over 200 pages which emphasizes their importance inasmuch as most urologic surgery in the young is occasioned by an anomalous development complicating infection.

Indications and contra indications are clearly expounded.

DISEASES OF THE NERVOUS SYSTEM OF INFANCY, CHILDHOOD, AND ADOLESCENCE. By F. K. F. and M. D. Spingarn. Ill. a. d. Baltimore. Md. H. C. Th. Co. 1937.
PEDIATRIC UROLOGY. By M. D. F. Campbell. M. S. M. D. F. A. C. S. With a Section on Bright's Disease in Infancy and Childhood by J. D. Lytle. A. B. M. D. Vols. 1 and 2. New York: The Macmillan Co. 1937.

THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE STOMACH AND INTESTINES. By William F. Cheney. B. L. M. D. H. C. A. Christ. M. D. Sc. D., LL. D. Ed. 1 of series. (Reprint of from Oxford Medical Press on Diagnosis and Treatment) N. Y. Rk. Oxford University Press 1936.

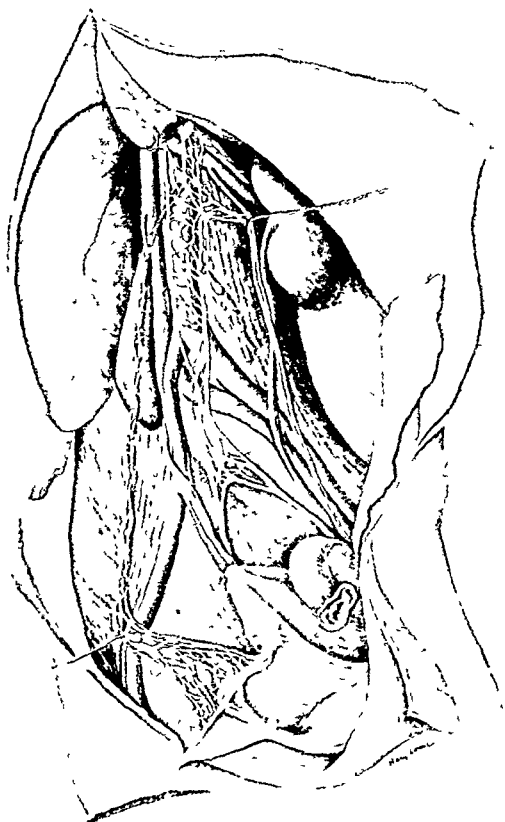


Fig 1 Dissection to show the abdominal sympathetic plexuses. Note the method of formation and triangular structure of the superior hypogastric plexus. The ovarian plexus on the left has been dissected throughout the course of the ovarian artery extending into the infundibulopelvic ligament.



Fig 2 Dissection showing the abdominal sympathetic plexuses. Here the superior hypogastric plexus is represented by bilateral nerve trunks which descend through the interiliac trigone. Note the density of the aortic (intermesenteric) plexus.

origin from the aorta. The nerve then bends toward the midline and continues downward through the interiliac space overlying the lumbar vertebræ (Figs 1, 6). The left intermesenteric nerve runs beneath the inferior mesenteric artery. As it passes beneath that artery it gives off several branches to the inferior mesenteric plexus. The left intermesenteric nerve then continues inferiorly, crosses the left common iliac vein and runs parallel with, and about one-half to 1 centimeter to the left of, the right intermesenteric nerve (Figs 1, 4, 6). The right and left intermesenteric nerve bundles below the bifurcation of the aorta are connected by oblique anastomoses to form the superior hypogastric plexus.

Due to the gradual divergence of the main nerve bundles to terminate in the inferior hypogastric nerves, the shape of the plexus is usually triangular (Figs 1, 4, 6).

In 8 per cent of the present series of 75 dissections, the intermesenteric nerves continued downward below the bifurcation of the aorta in parallel fashion without plexus formation (Figs 2, 12).

In 8 per cent the intermesenteric nerves united below the aortic bifurcation to form a central nerve bundle, which descended through the interiliac trigone.

Rami from the lumbar sympathetic ganglia. Each intermesenteric nerve receives peripheral rami from the lumbar sympathetic ganglia (Fig 3). The ramus from the first lumbar ganglion runs obliquely downward beneath the renal artery to join the intermesenteric



Fig. 3 Dissection to show the rami communicating between the lumbar sympathetic trunk and the aortic plexus

nerve at the level of the third lumbar vertebra. Two rami may arise from the second lumbar ganglion. The rami soon fuse to form a single nerve which continues downward and medially to join the intermesenteric nerve at the level of the origin of the inferior mesenteric artery. This branch may run directly to the upper pole of the superior hypogastric plexus. The ramus from the third lumbar sympathetic ganglion may join the upper pole of the superior hypogastric plexus or it may join the intermesenteric nerve between the origin of the inferior mesenteric artery and the bifurcation of the aorta. The ramus from the lowest lumbar ganglion runs beneath the inferior vena cava and the right common iliac artery to join the superior hypogastric plexus.

Delmas and Laux believe that the fibers from the first and second lumbar ganglia are the principal roots which strengthen the thin branch from the inferior mesenteric plexus and

the branches from the third and fourth lumbar sympathetic ganglia.

Inferior hypogastric plexus The superior hypogastric plexus divides over the middle of the first sacral vertebra to form the right and left inferior hypogastric nerves. These nerves 5 to 8 centimeters in length continue downward and laterally into the lateral rectal spaces. In the right and left pararectal space the inferior hypogastric plexuses are formed (Fig. 8). Each inferior hypogastric plexus represents the continuation of the superior hypogastric plexus along the lateral rectal space, and lies on the anterior surface of the rectum. It is intimately connected with the uterosacral ligaments.

The inferior hypogastric plexus gives rise to subordinate plexuses accompanying the hypogastric artery and its branches from which visceral branches are given off to the pelvic organs.

THE SURGICAL ANATOMY OF THE SUPERIOR HYOAGASTRIC PLEXUS

The common iliac arteries arise opposite the left side of the middle of the body of the fourth lumbar vertebra at the bifurcation of the aorta. Diverging from each other at an angle of 68 degrees in the female these arteries divide opposite the iliosacral articulation at the level of the lumbosacral junction to form the external iliac and the hypogastric arteries.

The common iliac arteries form the lateral boundaries of a triangular space. Elaut has called this the interiliac trigone. The apex of this space is at the bifurcation of the aorta. The base is represented by a line drawn horizontally across the promontory of the sacrum to meet the common iliac arteries where they divide into the external iliac and hypogastric arteries. The roof is formed by the posterior layer of the parietal peritoneum. The floor consists of the fourth and fifth lumbar vertebra and the upper portion of the first sacral vertebra with their intervening intervertebral discs (Fig. 1).

The interiliac trigone is approximately 6 centimeters in width at the base. The distance vertically from apex to base varies between 6 and 7 centimeters.



Fig 4 Photograph of an adult dissection showing the abdominal sympathetic plexuses and method of formation and structure of the superior hypogastric plexus Note relationship of the ureters to the interiliac trigone The upper third of the superior hypogastric plexus lies over the left common iliac vein

The interiliac trigone may be exposed through a vertical incision in the posterior layer of the parietal peritoneum (Fig 11) The incision is begun at the level of the promontory and extended vertically upward to the level of the aortic bifurcation By blunt dissection the two peritoneal flaps are reflected laterally as far as the common iliac arteries (Fig 12) The peritoneum frees easily from the underlying connective tissue layer Within the firm retroperitoneal connective tissue in the interiliac trigone the nerve fibers of the superior hypogastric plexus are to be found

The contents of the interiliac trigone consist of the following (Figs 7, 12) (1) a firm retroperitoneal connective tissue layer, (2) the components of the superior hypogastric plexus closely incorporated into the retroperitoneal

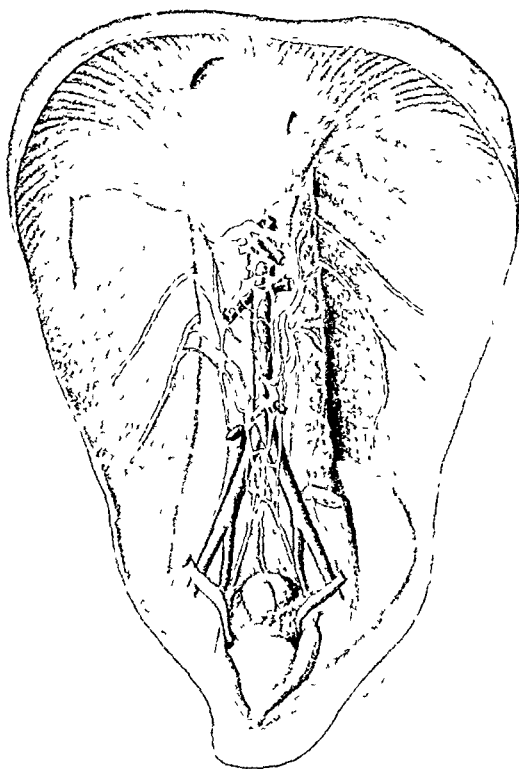


Fig 5 Cast made of the abdominal sympathetic plexuses in an infant The rami from the lumbar sympathetic trunks are shown clearly

connective tissue, (3) the left common iliac vein, which runs obliquely from right to left just below the bifurcation of the aorta, (4) the middle sacral artery and vein, overlying the prevertebral fascia in the midline and behind the connective tissue layer and hypogastric plexus, (5) the right ureter which is exposed as it crosses the right common iliac artery at the level of the bifurcation of that vessel into the external iliac and hypogastric arteries, (6) on the left border of the trigone the inferior mesenteric artery and its sigmoid branch which may be seen entering the root of the pelvic mesocolon

Variations in the superior hypogastric plexus
The superior hypogastric plexus is essentially a continuation of the intermesenteric plexus below the inferior mesenteric artery It includes the part of the plexus which extends from the superior part of the fourth lumbar

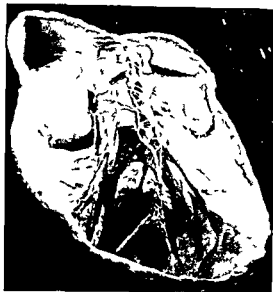


Fig. 6. An adult dissection. Location, structure and method of formation of the superior hypogastric plexus from the intermesenteric nerves are clearly shown. Note the relation of the plexus to the ureters, left common iliac vein, and middle sacral vessels.

vertebra to the middle of the first sacral vertebra. At the middle of the first sacral vertebra the plexus divides into the right and left inferior hypogastric nerves.

The plexus lies embedded in the retroperitoneal connective tissue in the interiliac triangle. After the peritoneal flaps have been reflected laterally to expose the trigone, fibers of the nerve plexus may be seen through the connective and adipose tissues. The fat and connective tissue may be dissected away and the plexus elevated with a blunt instrument. In thin individuals the nerves may be seen through the peritoneum. In its upper portion the plexus lies directly over the left common iliac vein.

The form of the superior hypogastric plexus depends upon the position taken by the intermesenteric nerves in the interiliac triangle. If the right and left intermesenteric nerves unite, a single nerve trunk is formed. If the nerves remain separated they may be joined by anastomoses of small nerve fibers, resulting in the formation of a plexus. However, the nerves may remain as two parallel nerve trunks without any attempt at plexus formation. Thus

TABLE I — VARIATIONS IN THE SUPERIOR HYPOGASTRIC PLEXUS FOUND IN THIS STUDY

	All	Infant	Total	%
Plexus type	19	44	63	94
Single nerve	1	5	6	8
Parallel nerves	3	3	6	8
			15	

TABLE II — ANALYSIS OF THE TYPES OF PLEXUSES

Triangular	29
Narrow	16
Broad	16
Arch shaped	1
Spider web	1

the configuration of the superior hypogastric plexus depends on the degree of convergence of the intermesenteric nerves.

All 3 of these configurations, namely, plexus, single nerve and bilateral parallel nerves, have been found during this study.

The present study includes a total of 73 dissections. On 23 adults and 52 infants the following types of plexus formation were found. A definite plexus was found in 84 per cent (63 cases), a single nerve in 8 per cent (6 cases) and bilateral parallel nerves in 8 per cent (6 cases). (Table I.)

In studying the reports of 309 dissections reported in the literature by various investigators, there was a plexus formation in an average of 70 per cent, a single nerve in 24 per cent and bilateral nerves in 6 per cent.

Latarjet and Bonnet believed that the plexus is united to form a single nerve trunk, and gave it the name "pre sacral nerve." Roussel reported a single nerve in 75 per cent and a plexus in 25 per cent. Delmas and Laur found a single nerve in 20 per cent and plexus formation in 80 per cent of his 80 dissections. Ferey reported only 15 per cent of single nerve formations in 13 dissections. Segond and Hovelacque considered the plexus arrangement as predominant. Llaüt found a plexus in 58 per cent (29 cases), parallel fibers in 16 per cent (8 cases), a single nerve in 24 per cent (12 cases) and an arch-shaped plexus in 2 per cent (1 case). Fontaine and Herrmann found that the nerves were usually in the form of a plexus. Kalberg in 38 dissections reported a plexus in 23, a single nerve in 8 and parallel fibers in 7. Learmonth reported a plexus in

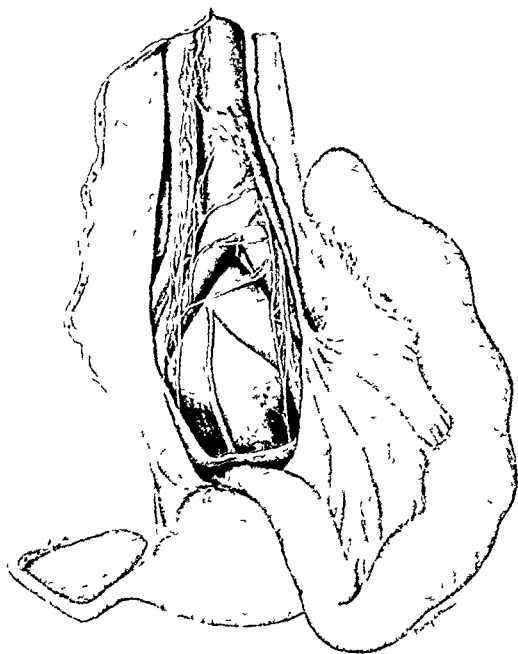


Fig 7 Dissection of the interiliac trigone to show the contents and structure of the superior hypogastric plexus. Here the plexus is represented by bilateral parallel fibers.

80 per cent, and a single nerve in 20 per cent. Davis in a series of 70 dissections found a plexus in 76 per cent and a single nerve in 24 per cent. Chianello identified a plexus in 53 per cent and a single cord in 22 per cent. Cordier, Jianu, Bernard, Hartmann-Weinberg believe that a plexus arrangement predominates. However, Bergier, Morisson, and Lacombe consider it a single nerve.

The plexus type occurs most frequently. However, the degree of plexus formation and the length and width of the plexus varies. The structure of the plexus may range from a narrow to a widely meshed plexus occupying a large area of the interiliac trigone (Fig 9). When the plexus formation does occur it most often assumes a triangular shape. It varies in width from 1 to 2 centimeters. The widest portion of the plexus is situated over the middle of the first sacral vertebra, where bifurcation into the right and left inferior hypogastric nerves usually occurs (Figs 1, 3). In a smaller number of cases the triangular configuration is less marked (Fig 9). (Table II.)

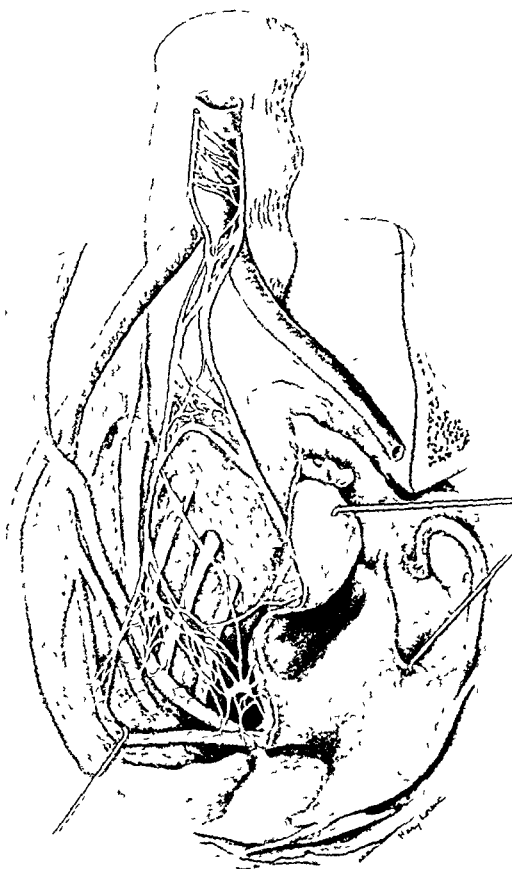


Fig 8 Dissection showing the bifurcation of the superior hypogastric plexus into right and left inferior hypogastric nerves. In the pararectal space each inferior hypogastric nerve ends in the formation of the inferior hypogastric plexus.

It is not unusual to find the superior hypogastric plexus situated to the left of the midline within the interiliac trigone. This occurred in 10 of the 23 dissections in adults. In 4 of these the plexus was found some distance to the left of the midline close to the left common iliac artery and adjacent to the root of the pelvic mesocolon. The plexus was found overlying the upper portion of the left common iliac vein. It was mistaken for the inferior mesenteric artery, which enters the root of the pelvic mesocolon. In these cases, after the parietal peritoneum was incised, elevation of the pelvic mesocolon raised the inferior mesenteric artery and revealed the

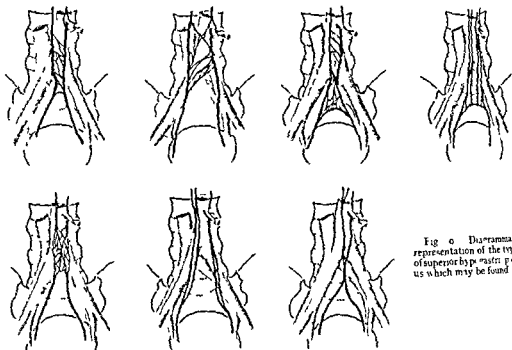


Fig. 6. Diagrammatic representation of the types of superior hypogastric plexus which may be found.

nerves lying over or along the right border of the left common iliac artery. The sigmoid and hemorrhoidal arteries were pushed to the left to expose the nerve plexus clearly.

Dobrzaniecki and Serahn found the plexus to the left of the midline in most cases. The possibility of displacement of the plexus to the left of the midline has not been emphasized by previous investigators.

The superior hypogastric plexus varies from 6 to 8 centimeters in length. It extends from the superior portion of the fourth lumbar vertebra to the middle of the first sacral vertebra. In adults it divides either over the middle or upper border of the first sacral vertebra. Occasionally it divides over the middle of the fifth lumbar vertebra. In infants the point of bifurcation into the inferior hypogastric nerves occurs at a higher level usually over the lower border of the fourth or fifth lumbar vertebra. Hovelacque gives the middle of the first sacral vertebra as point of termination of the superior hypogastric plexus.

From the above description it is apparent that the sympathetic nerve fibers to the pelvic

viscera are collected into an easily accessible bundle in the interiliac trigone. This anatomical arrangement makes sympathectomy simple as a means of operative intervention in certain disorders. As in the sympathetic system elsewhere the anatomical structure is subject to considerable variations. It is difficult to find two plexuses with the same anatomical architecture.

Middle sacral vessels. Posterior to the superior hypogastric plexus and left common iliac vein the middle sacral vessels descend through the center of the interiliac trigone.

Over the promontory of the sacrum the connective tissue stroma becomes thinned. The plexus lies on the prevertebral fascia overlying the fifth lumbar vertebra and the intervertebral disc between the fifth lumbar and first sacral vertebra. Hemorrhage from the middle sacral artery is due usually to overzealous denudation of the connective tissue layer overlying the fifth lumbar vertebra.

Left common iliac vein. The common iliac veins are formed opposite the sacro iliac articulation by confluence of the external iliac and

hypogastric veins. They converge as they ascend and unite opposite the upper border of the fifth lumbar vertebra and a little to the right of the midline to form the inferior vena cava (Jackson).

The left common iliac vein ascends more obliquely toward the right to cross the interiliac trigone. It passes over the left margin of the intervertebral disc between the fifth lumbar and first sacral vertebrae and over the fifth lumbar vertebra. The lower border of the left common iliac vein in the midline is 3.5 centimeters below the bifurcation of the aorta, and only 1 centimeter below the bifurcation of the aorta and only 1 centimeter above the upper border of the first sacral vertebra (Figs 1 to 8).

The left common iliac vein must be guarded carefully during any operative procedure within the interiliac trigone. It crosses the upper part of the trigone and practically subdivides it into an upper and a lower segment. *The superior hypogastric nerves cross this vein enmeshed in connective tissue.* Extreme gentleness is required in stripping the left common iliac vein of connective tissue and nerves because of its friable walls. It is best to start the dissection at the promontory, where the nerves can be identified and elevated with a blunt hook. Then the nerves and connective tissue can be dissected upward.

Ureters The ureters enter the inferior angles of the interiliac trigone. They cross the brim of the pelvis on either side at the level of the division of the common iliac artery into the external iliac and hypogastric arteries. They descend along the lateral walls of the pelvis in front of the hypogastric artery (Fig 10).

The right ureter is the one most likely to be seen within the operative zone (Fig 12). This ureter crosses the right common iliac artery at the level of the lower border of the first sacral vertebra 3.5 centimeters from the midline. Its position corresponds to the point of bifurcation of the common iliac artery into the external iliac and hypogastric arteries. The ureter is bound to the posterior layer of the peritoneum by connective tissue, but it is easily dissected away. Adhesion of the ureter to the posterior surface of peritoneum serves to differentiate that structure from the nerves and vessels in the interiliac trigone. The



Fig 10 Dissection to show the relation of the ureters to the interiliac trigone

nerves and vessels are intimately bound to the retroperitoneal connective tissue, but are not adherent to the posterior surface of the peritoneum.

The left ureter is hidden from view. As the peritoneum is dissected toward the left, the inferior mesenteric artery may be seen running through the root of the mesocolon. The ureter is completely covered by the lower part of the inferior mesenteric artery and its branches, the sigmoid and superior hemorrhoidal arteries (Figs 10, 12).

A. A. Davis, in a series of 12 operative cases, reports having seen an accessory ureter running in the midline on 3 occasions, closely simulating a single large presacral nerve. In the present study no such anomaly was encountered. In the infants, however, the right ureter often bent sharply toward the midline,

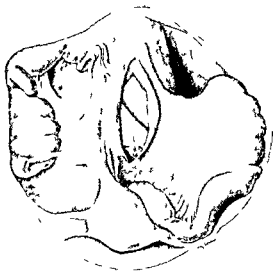


Fig. 11 Vertical incision made through the posterior parietal peritoneum extending upward from the promontory to expose the interiliac trigone. Note the long pelvic mesocolon.

where it could be seen through the thin layer of peritoneum.

Sigmoid and mesocolon. Most frequently the sigmoid is found in the left side of the pelvis lateral to the interiliac trigone. However it is not unusual to find the sigmoid displaced to the right side of the pelvis or over the interiliac trigone. Variations in the location of the colon are dependent on the length and manner of attachment of the mesocolon.

In most cases the mesocolon is short providing the sigmoid with limited mobility and allowing it to remain in the left side of the pelvis (Fig. 12). In 11 of the 23 adult dissections the mesocolon was prolonged to as much as 8 to 10 centimeters (Fig. 11). In these cases the sigmoid was found over the promontory of the sacrum covering the interiliac trigone or in the right iliac region. The mesocolon covered the posterior parietal peritoneum overlying the interiliac trigone. The sigmoid and mesocolon were easily displaced to the left allowing proper exposure of the interiliac trigone.

In one infant dissection (1 per cent) the mesocolon had a midline attachment. The two folds of peritoneum forming the meso-



Fig. 12 The peritoneal flaps have been dissected laterally to expose the interiliac trigone. Note the short pelvic mesocolon in this case.

colon covered the interiliac trigone at the level of the lower lumbar vertebrae and promontory. Roussel found this abnormality in 15 per cent of his cases, Elaut in 8 per cent and Cotte in 1 per cent. Bernard found this type of attachment in 1 case only.

Operative exposure of the interiliac trigone becomes more difficult in these cases, because the superior hypogastric nerves can be reached only by dissection through the layers of the mesocolon. When this difficulty is encountered it is necessary to incise both layers of the mesocolon to expose the peritoneum covering the superior hypogastric plexus. The mesocolon should be incised parallel with its root and one and one half centimeters from it to avoid the superior hemorrhoidal artery (Elaut).

TECHNIQUE OF OPERATIVE RESECTION OF THE SUPERIOR HYPOGASTRIC PLEXUS

In resection of the superior hypogastric plexus adequate exposure is essential. The patient must be completely relaxed by means of a suitable anesthetic and must be placed in the Trendelenburg position. The abdomen is best opened through a right rectus suprapubic incision, extending above the umbilicus. Since dissection of the nerves must be carried from

the promontory of the sacrum upward over the lower lumbar vertebrae, proper exposure of this field will not be obtained unless the upper angle of the incision is extended. In some cases, if the distance between symphysis and umbilicus is reduced, it is better to make the abdominal incision to the right of the midline, starting midway between the pubis and umbilicus and ending midway between the umbilicus and xiphoid. It is essential that the sacral promontory be freely exposed without interference from upper angle of incision.

The small intestines are packed out of the way, and the sigmoid is displaced to the left to expose the peritoneum overlying the lower lumbar vertebrae. A vertical incision is then made through the posterior parietal peritoneum, extending from the promontory upward to the bifurcation of the aorta (Fig 11). With a blunt edged curved scissors (Ferguson scissors are well suited) the peritoneal flaps are freed from the underlying connective tissue, and reflected laterally as far as the common iliac arteries. This exposes the interiliac trigone (Fig 12). Portions of the nerves composing the superior hypogastric plexus may be seen embedded in the connective tissue. By blunt dissection the nerve fibers can be identified clearly, and elevated by passing a blunt instrument behind them. As the plexus is put on the stretch, blunt dissection discloses the triangular shape of the plexus, and the inferior hypogastric nerves are to be seen running beneath the peritoneum toward the lateral rectal spaces. A wide portion of the plexus may be excised without ligature. Any bleeding which may occur is due to severing of the vasa vasorum and is controlled readily by pressure. Below the fourth lumbar vertebra there are no vessels of importance. The middle sacral vessels are situated here, embedded in connective tissue overlying the vertebrae.

If a central compact plexus is not easily identified, two bilateral nerve trunks may be present. In these cases it is probably best to remove the entire subperitoneal connective tissue layer, extending from the promontory upward to the aortic bifurcation and laterally to the common iliac arteries. This assures the practicability of thorough resection of all nerve fibers. At times the operator may identify one

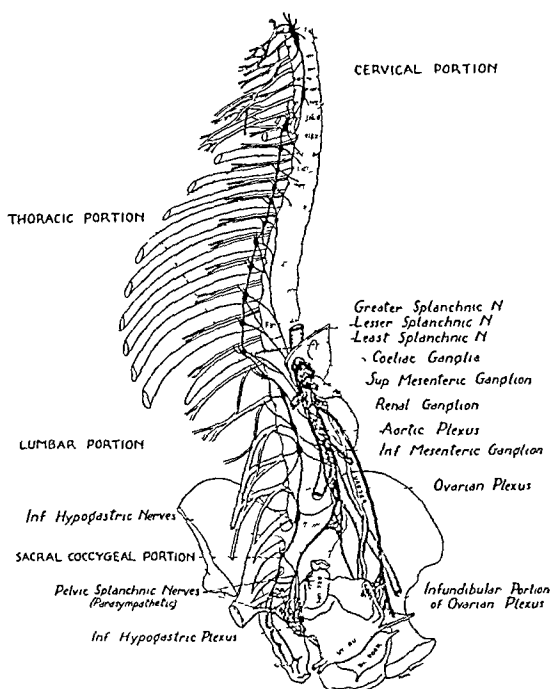


Fig 13 Diagrammatic sketch to show the abdominal and pelvic sympathetic plexuses and their communications with the main sympathetic trunk as well as with the pelvic nerve. Spinal nerves, white, sympathetic nerves, black, parasympathetics, gray.

single band of nerves and neglect to look for a second nerve trunk. Because of the possibility of bilateral parallel nerves one should never be satisfied with isolation of a single nerve until the existence of a mate is eliminated.

CONCLUSIONS

1 Seventy-five dissections were done in order to study the anatomy of the superior hypogastric plexus.

2 A plexus was found in 84 per cent, a single nerve in 8 per cent, and parallel nerve trunks in 8 per cent.

3 The superior hypogastric plexus always traverses the interiliac trigone. This is the space formed below the bifurcation of the aorta, bounded laterally by the common iliac arteries, and limited inferiorly by the promontory of the sacrum.

4 The left common iliac vein, the middle sacral vessels, and the right ureter are found within the trigone.

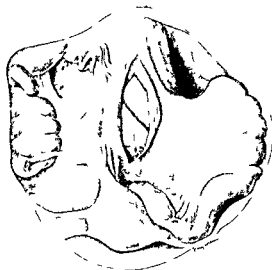


Fig. 11 Vertical incision made through the posterior parietal peritoneum extending upward from the promontory to expose the interiliac trigone. Note the long pelvic mesocolon.

where it could be seen through the thin layer of peritoneum.

Sigmoid and mesocolon. Most frequently the sigmoid is found in the left side of the pelvis lateral to the interiliac trigone. However it is not unusual to find the sigmoid displaced to the right side of the pelvis or over the interiliac trigone. Variations in the location of the colon are dependent on the length and manner of attachment of the mesocolon.

In most cases the mesocolon is short providing the sigmoid with limited mobility and allowing it to remain in the left side of the pelvis (Fig. 10). In 11 of the 23 adult dissections the mesocolon was prolonged to as much as 8 to 10 centimeters (Fig. 11). In these cases the sigmoid was found over the promontory of the sacrum covering the interiliac trigone or in the right iliac region. The mesocolon covered the posterior parietal peritoneum overlying the interiliac trigone. The sigmoid and mesocolon were easily displaced to the left allowing proper exposure of the interiliac trigone.

In one infant dissection (1 per cent) the mesocolon had a midline attachment. The two folds of peritoneum forming the meso-



Fig. 12 The peritoneal flaps have been dissected laterally to expose the interiliac trigone. Note the short pelvic mesocolon in this case.

colon, covered the interiliac trigone at the level of the lower lumbar vertebrae and promontory. Roussel found this abnormality in 15 per cent of his cases, Elaut in 8 per cent and Cotte in 1 per cent. Bernard found this type of attachment in 1 case only.

Operative exposure of the interiliac trigone becomes more difficult in these cases, because the superior hypogastric nerves can be reached only by dissection through the layers of the mesocolon. When this difficulty is encountered it is necessary to incise both layers of the mesocolon to expose the peritoneum covering the superior hypogastric plexus. The mesocolon should be incised parallel with its root and one and one half centimeters from it to avoid the superior hemorrhoidal artery (Elaut).

TECHNIQUE OF OPERATIVE RESECTION OF THE SUPERIOR HYPOGASTRIC PLEXUS

In resection of the superior hypogastric plexus adequate exposure is essential. The patient must be completely relaxed by means of a suitable anesthetic and must be placed in the Trendelenburg position. The abdomen is best opened through a right rectus suprapubic incision extending above the umbilicus. Since dissection of the nerves must be carried from

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CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, THE LAHEY CLINIC

COMPLETE REMOVAL OF THE STOMACH FOR MALIGNANCY

With a Report of Five Surgically Successful Cases

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IN a discussion of total gastrectomy for malignant lesions of the stomach with anastomosis of the jejunum to the esophagus, it seems proper to state at once that the number of cases in which the operation can be employed is, quite naturally, limited, that since the operation is to be considered only in those cases in which a large part of the stomach is involved, extragastric metastases, even though they are not visible, and the operation is not justifiable if they are visible, are present in practically all of the cases. It is possible, however, if the malignant lesion in the stomach is a leiomyosarcoma, as in Case 5 here reported, that at least the idea of possibility of a cure may be entertained. In those cases in which the malignant lesion in the stomach is carcinoma, one cannot reasonably expect to be able to accomplish anything more than a prolongation of life but that with reasonable digestive comfort. In the reported 5 cases in which treatment was surgically successful, 1 patient, who had a carcinoma involving practically the entire stomach, lived $3\frac{1}{2}$ years and earned her living during nearly all of that period, 1 has lived now a little more than a year and does not have any evidence of recurrence, 1 (leiomyosarcoma) has been operated upon too recently to be worth considering from the viewpoint of prolonged life, 1 patient died in 6 months, and 1 died 9 months after operation. The latter 2 patients could hardly be considered as having had their lives prolonged or demise made very much more comfortable. It seems wise to present the above facts clearly lest over-enthusiasm on our part or others result from a report on this subject.

It is but fair, on the other hand, to say that the woman who has now lived a year without evidence of recurrence has obtained real and worth while prolongation of life without disturbing digestive

difficulties, with the ability to carry on a great many activities and that without this procedure she would now either be dead or in a most distressing stage of carcinomatous involvement. In consideration of the patient who lived $3\frac{1}{2}$ years, certainly 2 to $2\frac{1}{2}$ years of this period was pure gain to her, based upon her expectation of life without this operation, and during these years she had no real difficulties in her digestive comfort and was able to carry on her usual activities. The woman with a leiomyosarcoma of the stomach, who has recently left the clinic after a successful total gastrectomy was performed, is at least relieved of the repeated massive gastric hemorrhages from the ulcerating sarcoma for which she entered the clinic, and has, in addition, the very definite possibility of prolongation of life and possible cure.

It may conservatively be stated we believe from our experience with total gastrectomy that this operation will be justifiable in occasional cases after exposure of the lesion, determination of its extent, and the absence of visual metastasis.

Because of the fact that leiomyosarcomas involving the stomach remain localized, without glandular metastasis, over long periods of time and because they are of a lower grade of malignancy than are carcinomas of the stomach, total gastrectomy may well be employed here even, as was the case in this patient, with practically all of the stomach involved. The risk of operation in the hands of those who have had experience with this procedure is now not prohibitive, the prospect of prolongation of life is great, and, should recurrence quickly take place, the end is not made any more distressing than would be the case if the operation had not been undertaken.

There are two distinct types of carcinomatous involvement of the stomach. In one, the more

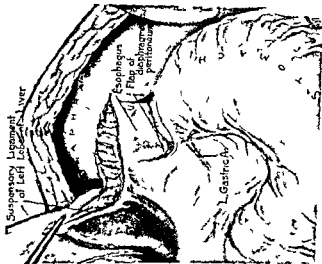
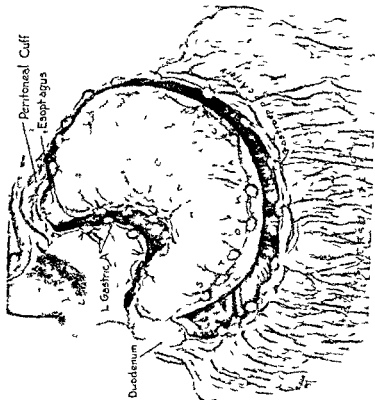


FIG. 1. Through a left rectus incision the upper end of the stomach is exposed. The left lobe of the liver is detached from the diaphragm by severing the avascular ligament which fixes it to that structure. The left lobe of the liver is then pulled to the right exposing the point where the esophagus penetrates the diaphragm. The peritoneal flap which is later to be attached to the jejunum below at the point of anastomosis as shown in figures 4, 5 and 6 is now fashioned. The

posterior flap is to be fashioned after the stomach has been completely detached.

FIG. 2. All of the blood supply of the stomach along the greater and lesser curvature has been ligated. The peritoneal cuff over the esophagus as shown in Figure 1 has now been turned upward. The lower end of the stomach is now ready to be severed by transection through the duodenum.

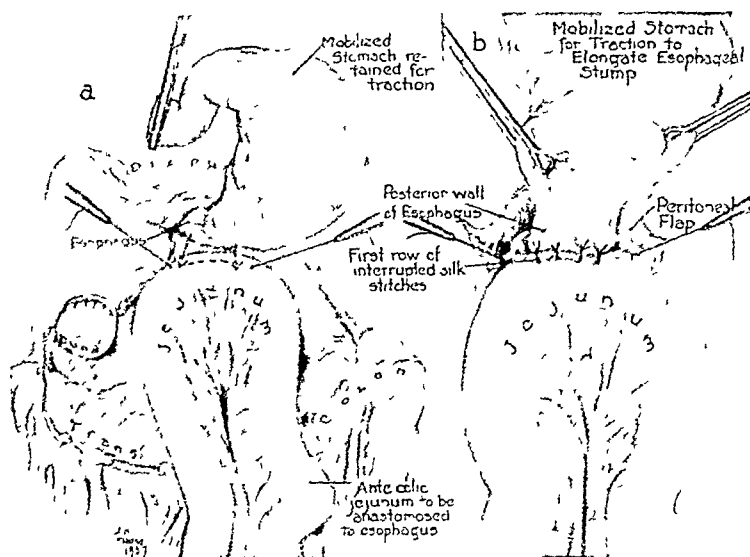


Fig 4 a, The duodenum has been cut across. The stomach has been turned up and retained for traction. For the purposes of illustration, in a and b, the stomach is not shown wrapped in gauze to protect the wound edges from contamination with cancer cells. Note in inserts a and b that the esophagus is freed from the diaphragm for a considerable distance and so pulled down that direct approximation of the jejunum to it is made easier. In a, a long loop of jejunum has been brought up in front of the transverse colon and is to be approximated at the dotted line, marked by arrows, to the esophagus. In b, the posterior row of black silk stitches between the esophagus and the jejunum has been inserted.

illustrations) demonstrate a rigid walled stomach without peristaltic waves, through which barium quickly passes, exploration as to the possibility of performing total gastrectomy is distinctly justifiable.

Total gastrectomy in our first 2 patients resulted in fatalities because these patients were not well selected, both having too far advanced lesions. Failure in these cases, however, was largely attributable to our lack of knowledge and experience concerning the technical management of these cases. An attempt was made in one to employ a stomach clamp on the stump of the esophagus, an almost impossible procedure at least for us and one that distinctly hampered the security of the suture line, and in the other the esophagus was cut completely across and, with its end open, a direct anastomosis was made between the open end of the esophagus and the side of the jejunum. This resulted in spilling of infected esophageal contents which undoubtedly played a part in the fatality by the production of peritonitis. Total gastrectomy was then performed successfully in 3 cases. Another fatality resulted from the unwise application of the operation to a patient in whom the disease was too far

advanced, and successful total gastrectomy was then done in 3 cases with no fatalities, making attempted total gastrectomy in 8 cases, with fatalities in 3 cases, and success surgically in 5 cases.

From this experience much has been learned in the technical management of this operation, and a description of the operation of total gastrectomy as it is now employed, together with the steps which have been developed in this clinic to add to its safety is here presented.

The operation is now done with the patient under high spinal anesthesia, nupercaine, 1:1500, being used. This type of spinal anesthesia, with the use of 8 to 20 cubic centimeters, can be trusted to last at least 3 hours and thus allows plenty of time for the completion of the operation, with the abdominal wall completely relaxed and with a satisfactory and adequate exposure. I feel sure that this anesthetic has greatly facilitated and added to the safety of the operation particularly in regard to its technical steps, and, in addition, has resulted in lessened drops in blood pressure and a lessened degree of shock to these patients. I believe that the 3 deaths in this series are at least in some part attributable to the inadequateness of the spinal anesthetic as given then, in

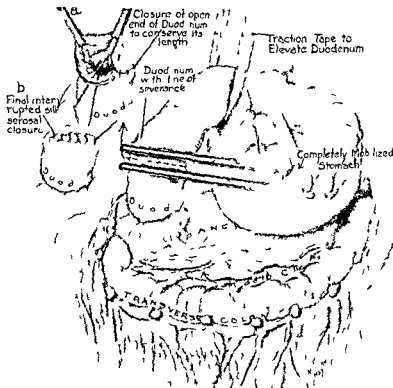


Fig. 3. The stomach and duodenum are completely mobilized the duodenum grasped between clamps and to be cut across with a cautery at the dotted line. Inserts a and b show the method employed in closing the duodenum. In a the clamp has been removed from the duodenum and the duodenum has been inverted with its end open and sucked out. This leaves sufficient duodenum to invert it easily (note the traction tape which elevates the duodenum out of its bed to make its exposure more satisfactory). Insert b the final closure of the duodenum with interrupted silk seromuscular sutures.

common type, the malignant lesion is local on the greater or lesser curvature or in the pyloric region, with early and extensive metastatic involvement of the adjacent lymph nodes. It is this type of carcinoma of the stomach which we are so likely to see late in its course and in which the end results in terms of percentage of cures are so discouraging. In the other type in which we are interested in this discussion the lesion is not local but one in which the energy of the malignant growth appears to have expended itself in infiltrating throughout the walls of the stomach without apparent metastatic involvement of the adjacent lymph nodes. On microscopic examination of the stomach wall from such a case as shown in the photomicrographic illustrations the cancer cells appear to be streaming down between the muscle bundles of the stomach to form the

linitis plastica or leather bottle type of stomach. It is in this type of extensive carcinomatous involvement of all or nearly all of the stomach without apparent metastasis that total gastrectomy is well worth considering.

Although the operability of the malignant lesion of the stomach cannot with any degree of certainty be determined before operation either from the history or roentgenologic evidence, there are certain points which suggest that an exploration is justifiable to determine the possibility of total gastrectomy. In those patients who by roentgenologic evidence and chemical findings of the gastric contents obviously have extensive carcinoma of the stomach but in whom evidence of secondary effects such as cachexia, fixation of the mass and palpable metastasis are not present and in whom roentgenograms (roentgenologic

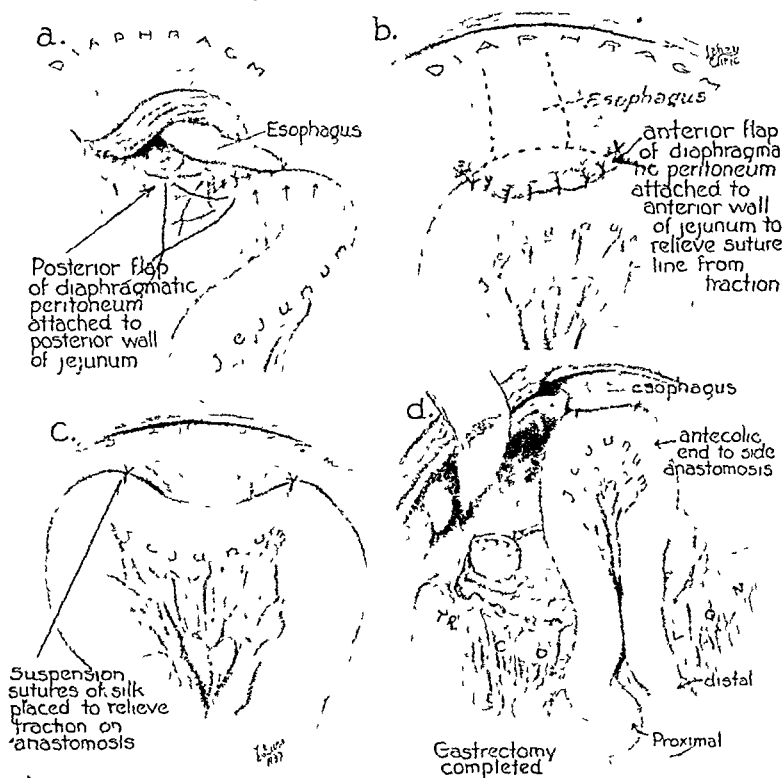


Fig 6 With the anastomosis between the end of the esophagus and the side of the jejunum now completed, the posterior flap of peritoneum fashioned from the diaphragm is sutured to the jejunum for its support and to remove the weight of the antecolic jejunum from the line of anastomosis. In b, the anterior flap of diaphragmatic peritoneum is now attached to the anterior wall of the jejunum, likewise, to relieve the suture line from the weight and traction of the loops of jejunum. In c, the jejunum has been suspended to the diaphragm by sutures of silk to relieve traction on the angles of the anastomosis, as was done in the last case. In d, the operation is completed. Note the long proximal antecolic loop of jejunum, note the absence of any entero-enterostomy. It is the long proximal loop which is to serve as a substitute for a stomach in these cases in which all of the stomach has been removed. Were entero-enterostomy done, this proximal loop immediately would drain and would not then serve as a substitute for the stomach.

After the abdomen is opened, the avascular attachment of the left lobe of the liver to the diaphragm is severed with scissors (Fig. 1) and the left lobe of the liver is folded to the right with a gauze pad over it and held in this position with a long bladed retractor. This maneuver, proposed by George Gray Turner and others, provides adequate exposure of the left half of the diaphragm and the point at which the esophagus passes through that structure. The gastrocolic attachments to the greater curvature are then ligated from the duodenum up to the point where

the greater curvature joins the esophagus. A warning should be stated here as to the danger of injury to the splenic veins as they enter the hilum of the spleen when the vessels running to the greater curvature are ligated (Fig. 2). This structure overlies the hilum of the spleen and at this point injury to splenic veins causes troublesome bleeding which is very difficult to control without doing a complete splenectomy.

The vessels of the lesser curvature are next controlled and the gastric vessels ligated high beside the point at which the esophagus penetrates the

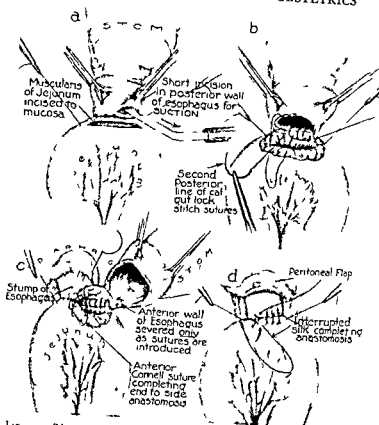


Fig. 5. a The posterior row of sutures between the jejunum and the esophagus has been inserted. The jejunum has been incised to the mucosa and the dotted line indicates where the esophagus is to be incised. The esophagus is incised for a small distance at its left side but only of sufficient length to permit the introduction of a suction tube. The stomach and esophagus are carefully sucked out to prevent soiling from the contents. In b the jejunum is incised through its mucosa and the posterior row of lock stitches of catgut put in between the esophagus and the jejunum. As stated in the text the posterior wall of the esophagus is incised only as the lock stitches are applied. In c the anterior row of catgut sutures is applied by the Connell method of in and over sutures and the esophagus is cut away either completely or as the stitches are inserted. In d the anastomosis is now completed with interrupted silk sutures inserted between the esophagus and the jejunum. Notice the peritoneal flap which is to be sutured to the jejunum to take the weight off the suture line.

terms of its limited time period to the fact that when the patient came out of the novocain spinal anesthesia which was then given a deep general anesthetic had to be administered which resulted in unsatisfactory exposure and produced advanced degrees of shock.

It is of interest as far as the anesthesia goes to record that following unsatisfactory experiences with novocain spinal anesthesia with its limited length of time of relaxation Cases 1, 2 and 3

performed before the development of dilute nupercaine spinal anesthesia were successfully accomplished under intratracheal cyclopropane anesthesia combined with regional infiltration with novocain and splanchnic block with satisfactory relaxation and exposure.

All of these operations have been done through long left rectus incisions additional cross incisions or incisions involving resection of ribs have not been necessary.



Fig 10

Fig 10 Case 2 Barium roentgenogram before operation, showing extent of involvement of the stomach by carcinoma

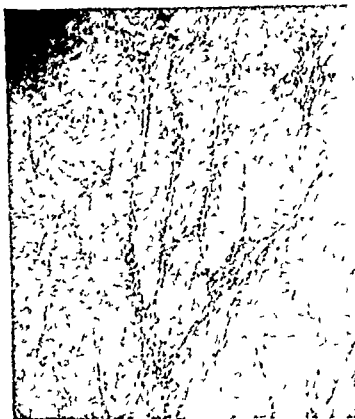


Fig 12

Fig 12 Case 2 Linitis plastica type of carcinoma



Fig 13

Fig 13 Case 2 Barium roentgenogram after operation, showing the anastomosis between the esophagus and the jejunum and the dilated jejunum serving as a receptacle for food

After the region below the esophagus is carefully protected with gauze pads as a precaution against possible contamination during the anastomosis, a long loop of jejunum, one that can readily be approximated to the esophagus, is now brought up over the transverse colon and attached by interrupted silk sutures to the posterior wall of the turned-up esophagus with its stomach still attached. Here it is important to speak of a point which we have learned as the result of our experience, that is, that one interrupted black silk approximation should be placed at each end of the posterior line of sutures first and that these sutures with their ends cut long and held in hemostats should be pulled apart and kept pulled apart while this posterior row of interrupted silk approximation stitch is being placed, thus insuring sufficient caliber to the anastomotic opening between the esophagus and the jejunum. Failure to appreciate the danger of making this opening too small made it necessary in one of our cases in which the patient is now living to institute post-operative dilatation because of suture narrowing.

With the posterior row of silk sutures inserted, an incision is made in the jejunum of a length to correspond to the width of the esophagus with the two traction sutures pulled apart. In none of the latter 5 cases in which the surgical outcome was successful were intestinal clamps employed either upon the esophagus or upon the jejunum. A very small incision is now made into the esophagus at one end and into this is quickly introduced a rubber catheter attached to a suction apparatus and all of the contents of the esophagus are care-

fully sucked out. When this has been accomplished, the incision in the esophagus is extended a short distance and a second row of continuous sutures of catgut is applied between the posterior cut edge of the jejunum and the posterior edge of the esophagus as far as it is cut, care being taken to lock such stitches to control oozing from the cut edges but also to prevent shortening of the suture line, which would result in narrowing of the lumen. As the cut portion of the esophagus is approximated to the cut edge of the jejunum, a little more esophagus is cut across and sutured to the jejunum until the entire posterior second layer of locked catgut sutures is inserted. With a double posterior row of sutures now inserted, there is no danger of the esophagus slipping upward and the anterior wall of the esophagus is

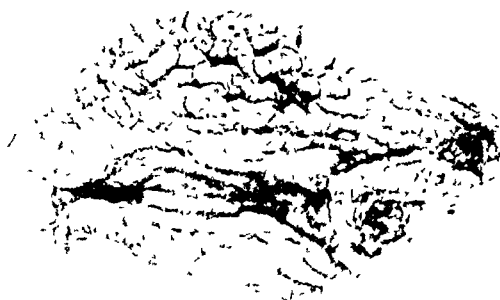


Fig 11 Case 2. Gross specimen



Fig 7



Fig 8



Fig 9

Fig 7 Case 1 Barium roentgenogram before operation showing almost complete involvement of the stomach by carcinoma

Fig 8 Case 1 Barium roentgenogram after total gastrectomy and anastomosis of jejunum to esophagus

Note dilated jejunal loop serving as a substitute for the stomach

Fig 9 Case 1 Photomicrograph of a section of the carcinomatous infiltration in the wall of the first type of malignancy

diaphragm. The wound edges are now draped, in order to protect them from soiling with the cellophane pads which I have devised. The duodenum is then cut across and its open end carefully inverted with catgut and reinforced with mattress sutures of silk (Fig 3).

The stomach is now turned up. One of the most important points which we have learned as the result of our experience with this operation is the need of returning the entire stomach hanging by the esophagus as that structure passes through the diaphragm. The entire stomach is wrapped in a gauze pad to prevent contact of its carcinoma-filled walls with the operator's hands and with the surrounding tissue. With the stomach used as a handle, traction can be made so that flaps of diaphragmatic peritoneum can be cut posteriorly and anteriorly (Figs 4, 5 and 6) where the peritoneum is reflected from the diaphragm over the esophagus to be utilized as will be described later to suture to the jejunum below the line of anastomosis, thus taking the weight of the attached jejunum and its mesentery off the line of anastomosis. This also is one of the most important technical points which we have developed since if this is not done the anastomosed jejunum brought up over the transverse colon as an antecolic anastomosis hangs by its own weight together with its mesentery and supported transverse colon, entirely upon the suture line of the anastomosis and ascends and descends with diaphragmatic motion unless preliminary crush

ing of the phrenic nerve has been done. It is I believe undesirable to crush the phrenic nerve since this adds to the danger of pulmonary complications in an operative procedure in which this danger is already present to a high degree. The method of cutting posterior and anterior peritoneal flaps from the diaphragm and esophagus and then attaching these flaps with interrupted silk sutures to the wall of the jejunum below the line of anastomosis, relieving thus the anastomotic suture of all strain is I believe an important factor in diminishing the risk of separation of the jejunum from its attachment to the esophagus as a structure at this point without peritoneal covering and of such consistency that it will not hold sutures well.

After the peritoneal flaps have been dissected free and fashioned into flaps for later attachment to the jejunum (Figs 4, 5 and 6) traction is made upon the stomach. With gauze on the finger or in a long right angle elastic duct clamp, the cellular tissue about the esophagus is wiped upward until 2 to 3 inches of the intrapleural portion of the esophagus are drawn down, care being used not to open its attached pleura. By this plan enough esophagus can be pulled down out of the thorax so that the point at which the anastomosis is to be made between the end of the esophagus and the side of the jejunum is much nearer the level of the abdominal wall and thus this anastomosis can be performed much more easily and with greater safety.



Fig 18 Case 4 Barium roentgenogram before operation, showing practically complete involvement of the stomach by carcinoma

Following the completion of the anastomosis, the left lobe of the liver is returned to its normal position beneath the diaphragm but no attempt is made to suture it to the diaphragm from which it has been detached. The abdomen is then closed by whatever method one desires. In many of our cases the abdominal incisions have been closed following the total and subtotal gastrectomy with a single layer of catgut in the peritoneum, the remaining layers are closed by interrupted through and through mass sutures placed quite close to the wound edges and close together. Although we do not wish as yet definitely to advocate this method of closure of abdominal wounds after total and subtotal gastrectomy, one layer closure has definite advantages in saving of time and quite possible advantages in lessening wound complications.

Following operation, the feeding of these patients is turned over to the gastro-enterological section of the clinic, and their plan is here submitted. No food or fluid is given by mouth for 4 days, all administrations being given intravenously. On the fifth day after operation, small amounts of malted milk or strained cream of wheat gruel are given every hour. The usual initial feedings consist of $\frac{1}{2}$ ounce and after a day or two this amount is increased to 1 ounce and later to 3 ounces. About the eighth day after operation, cream of wheat is given at 10 00 in the morning and a soft-cooked egg at 4 00 in the afternoon. If this is well tolerated, other feedings are added at intervals of approximately 2 hours, so that the patient is getting a small, soft feeding every 2 hours. He is encouraged to drink water in addition to these feedings, as often as he likes.



Fig 19 Case 4 Gross specimen of the totally removed stomach. Note the linitis plastica type of carcinomatous infiltration of its walls. The defect on its anterior wall is the section removed for microscopic examination.

About the fourteenth or fifteenth day after operation, the patient is placed on a comparatively full diet, starting with five small meals daily. The soft, 2-hour feedings and the malted milk and gruel every hour are omitted. These small meals include cooked cereals, soft cooked eggs, cooked fruits, broiled bacon, chicken, fish, lamb or beef, baked potato or mashed potato, puréed vegetables and bland dessert. At the beginning of this new regimen, the patient is told that he need not eat all of his food on any one tray, but he is encouraged to eat as much as he can comfortably hold. By the time of his discharge from the hospital, he is usually eating all of the food on his trays and enjoying his meals. He is kept on a bland diet for several weeks after dismissal from the hospital. The first change that is made is in the frequency of the feedings.

After he can take three meals without any particular discomfort, he is allowed to have unstrained vegetables. If at any time he experiences discomfort, he is advised to return at once to a bland diet with frequent feedings, eliminating the solid foods for 2 or 3 days.

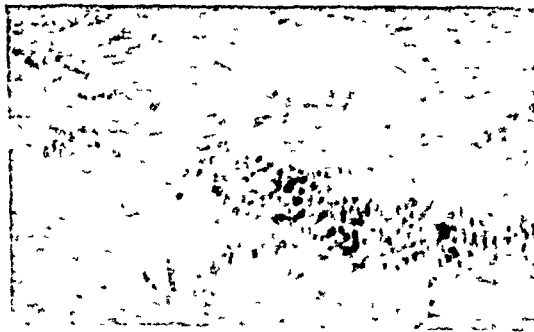


Fig 20 Case 4 Photomicrograph of a section of the gastric wall.



Fig 14

Fig 14 Case 3 Barium roentgenogram before operation showing the extent of involvement of the stomach by carcinoma



Fig 16

Fig 16 Case 3 Photomicrograph of section showing



Fig 17

limitis plastica type of infiltration of the gastric wall
Fig 17 Case 3 Barium roentgenogram after operation showing dilated loop of jejunum serving as a substitute for a stomach

entirely severed thus completely detaching the stomach from the esophagus. The posterior row of catgut sutures is now continued as a Connell suture, as in gastro-enterostomy, onto the anterior wall and the anterior wall of the esophagus is united to the anterior wall of the jejunum. Care being taken at all times to make traction upon the two original silk guy stitches in an outward direction in order to maintain the caliber of the anastomotic opening between the esophagus and jejunum. An anterior row of interrupted silk sutures is now inserted and with the anastomosis completed the prepared posterior apron of peritoneum is attached to the jejunum below the line of anastomosis by interrupted silk stitches and the anterior peritoneal flap is attached in the

same way to the jejunum below the line of suture. This as already stated is a most important step in making the operation safer, since it removes all weight and tension from the suture line. No entero-enterostomy between the two loops of the anastomosed jejunum is done.

Many of the visitors to the clinic who have witnessed these operations of total gastrectomy and many others who have seen the illustrations of this technical procedure in our exhibits at meetings have been a little shocked at the fact that jejunojejunostomy is not performed in these cases and have asked us if we have not had trouble with obstruction at the point of jejunoesophageal anastomosis. I believe that to do jejunojejunostomy in these cases is a mistake. The danger is not that the jejunal contents will not pass along the jejunum but that, with inadequate caliber to the anastomosed esophagus food will not pass from the esophagus into the jejunum.

We have attempted by leaving a long proximal loop of jejunum attached to the esophagus to make this loop at least in part serve as a substitute for a stomach. Illustrations taken after the ingestion of barium show a considerable accumulation of the barium meal in the proximal jejunal loop. We have had no trouble with these long proximal loops draining past the anastomosed esophagus and I believe it is a disadvantage to add jejunojejunostomy to the procedure.



Fig 15 Case 3 Gross specimen



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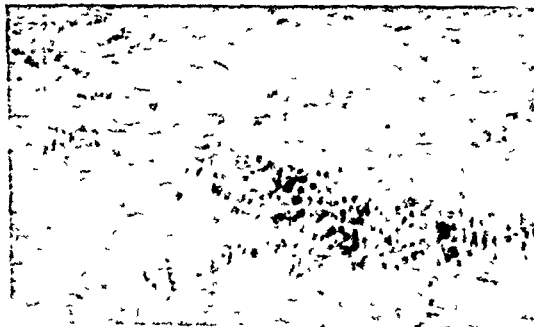


Fig 20 Case 4 Photomicrograph of a section of the gastric wall.



Fig 21

Fig 21 Case 5 Barium roentgenogram showing the almost complete involvement of the stomach by large leiomyosarcomatous masses



Fig 23

typical leiomyosarcoma of the stomach



Fig 24

Fig 24 Case 5 Postoperative barium roentgenogram showing the anastomosis and loop of jejunum serving as a stomach

As would be expected, rather severe grades of secondary anemia occur after operation owing to the lack of a stomach. Anemia in these cases has been satisfactorily controlled by the administration of liver iron and hydrochloric acid. The patient is instructed to take from 20 to 30 drops of dilute hydrochloric acid with each meal.

Vitamin concentrates in one form or another also are given. It is surprising how well these patients eat and how well their nutrition is maintained.

REPORT OF CASES

CASE 1 A woman aged 36 years came to the clinic August 20, 1920, because of nausea and gas and loss of appetite of 11½ years duration. She had had severe pain in the epigastrium which was worse since she had the grippe in December 1928. She had lost 20 pounds since November 1928.

Examination at the clinic revealed that the erythrocytes numbered 4,140,000 and leucocytes 2,600, the hemoglobin was 85 per cent. On gastric analysis the total acidity was 1 free hydrochloric acid of blood grade 2 was found. A roentgenologic diagnosis was made of a tumor of the greater curvature of the stomach (Fig 21).

September 14, 1920, total gastrectomy, esophagojejunostomy and entero-enterostomy were performed. The pathologist's report was colloid carcinoma of the stomach of the linitis plastica type with metastasis to the lymph nodes (Figs 8 and 9).

November 9, 1920, erythrocytes numbered 3,050,000 and the hemoglobin was 65 per cent. The patient was able to return to her former work and remained in comparatively good health for more than 4 years. She died January 7, 1925, of uræmia.

CASE 2 A woman aged 64 years came to the clinic May 1, 1925, because of stomach trouble. She had had a sudden attack of epigastric pain 5 months previously and had vomited since that time. Actual pain had not been present but she had continued to have distress after meal with regurgitation.

Examination at the clinic revealed that the erythrocytes numbered 4,510,000, the hemoglobin was 75 per cent. On gastric analysis the free hydrochloric acid was 7 and total



Fig 22 Case 5 Cross specimen

acidity, 24, no blood was found. Roentgenologic examination revealed a carcinoma of the stomach (Fig. 10).

At operation, May 20, 1933, a carcinoma simplex of diffuse type was found which involved the entire stomach, and total gastrectomy was performed (Figs. 11, 12, and 13). After operation the erythrocytes numbered 4,160,000, and the hemoglobin was 80 per cent.

On roentgenologic examination, March 8, 1934, 10 months after operation, a new carcinoma was found in the transverse colon. The patient died September 23, 1934.

CASE 3. A woman, aged 57 years, came to the clinic December 20, 1933, because of severe pain after eating and loss of weight and strength. She had had vague indigestion for years. On August 15, 1933, she began to have severe distress. Her usual weight was 135 pounds, on admission it was 107 pounds.

Erythrocytes numbered 4,040,000, leucocytes, 7,850, and the hemoglobin was 74 per cent. Gastric analysis revealed total acidity, 9, and free hydrochloric acid, 5, blood, grade 4, was found. The pre-operative roentgenogram is shown in Figure 14.

At operation, January 2, 1934, a carcinoma simplex of the linitis plastica type was found and total gastrectomy performed (Figs. 15, 16, and 17). August 23, 1934, on examination elsewhere, evidence of recurrence was found. The patient died 9 months after operation.

CASE 4. A woman, aged 61 years, came to the clinic November 9, 1936, because of abdominal pain. She had lost 13 pounds. Gastric analysis revealed total acidity, 18, and free hydrochloric acid, 4, no blood was found. Erythrocytes numbered 3,320,000, leucocytes, 7,900, and the hemoglobin was 70 per cent. The pre-operative roentgenogram is shown in Figure 18.

Total gastrectomy was performed December 7, 1936, and a carcinoma of the linitis plastica type was found (Figs. 19 and 20). No glands were seen outside of the stomach or in the mesentery.

December 28, 1936, erythrocytes numbered 3,690,000 and leucocytes, 7,300, the hemoglobin was 74 per cent. A constriction of the esophagojejunal juncture was dilated February 25, 1937, and this procedure has been repeated at intervals. In February, 1937, when the patient returned for examination and dilatation, no evidence of recurrence was found. Her digestive processes are quite reasonably satisfactory, as is her general activity and state of health.

CASE 5. A woman, aged 27 years, came to the clinic October 8, 1937, because of sudden onset of massive gastric

hemorrhages, without previous symptoms. Her appetite had been good and she had not had any digestive disturbances. Operation had been performed elsewhere in December, 1933, and several lesions which were thought to be benign had been removed from the stomach.

Examination at the clinic was negative except for her gastric condition. The erythrocytes numbered 3,460,000 and leucocytes, 6,600, the hemoglobin was 53 per cent. On roentgenologic examination, multiple new-growths, probably leiomyosarcomas, were found occupying practically the entire stomach (Fig. 21).

Total gastrectomy, with anastomosis of the jejunum to the esophagus, was performed October 18, 1937. The pathologist's report was leiomyosarcoma of the stomach (Figs. 22, 23, and 24). Examination of this patient in January, 1938, showed the hemoglobin to be 89 per cent, the erythrocytes numbered 5,800,000. Her weight had remained the same (90 pounds). At this time her general condition was quite satisfactory.

SUMMARY

Care must be exercised in the selection of patients to be submitted to total gastrectomy.

In the cases of carcinoma suitable for this operation, life may be prolonged but few if any cures may be expected. In cases of leiomyosarcoma, with early operation, it is not unreasonable to assume the possibility of a cure.

Technical procedures which we have developed as the result of our experience and which we believe make the operation easier and safer are submitted.

The successful cases are briefly reported, together with pre-operative and postoperative data. Total gastrectomy has now been successfully accomplished by a number of surgeons. It is a demonstrably justifiable procedure from the point of view of its technical performance and it may be done with a not excessive mortality. The ability of patients to exist in reasonable comfort without a stomach has been established.

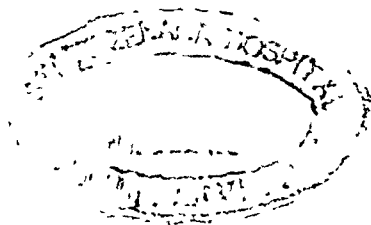




Fig. 21



Fig. 23



Fig. 24

FIG. 21 Case 5 Barium roentgenogram showing the almost complete involvement of the stomach by large leiomyosarcomatous masses

Fig. 23 Case 5 Photomicrograph of section showing

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As would be expected rather severe grades of secondary anemia occur after operation owing to the lack of a stomach. Anemia in these cases has been satisfactorily controlled by the administration of liver iron and hydrochloric acid. The patient is instructed to take from 20 to 40 drops of dilute hydrochloric acid with each meal.

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November 9, 1929, erythrocytes numbered 3,050,000 and the hemoglobin was 63 per cent. The patient was able to return to her former work and remained in comparatively good health for more than 3 years. She died January 1, 1933, of recurrence.

CASE 2 A woman aged 14 years came to the clinic May 15, 1933, because of stomach trouble. She had had a sudden attack of epigastric pain 4 months previously and had vomited. Since that time actual pain had not been present but she had continued to have distress after meals with regurgitation.

Examination at the clinic revealed that the erythrocytes numbered 4,510,000; the hemoglobin was 75 per cent. On gastric analysis the free hydrochloric acid was 7 and total



Fig. 22 Case 5 Cross specimen

may first bring the posterior edge of the peritoneum into view. Aside from the fact that the lumbar trigonum is the anatomical point for drainage of the kidney, the most important feature of having a tube come out at this point is that the patient can lie comfortably on her back without kinking or bending of the tube. This is most important in the postoperative care of these patients.

Thirteen of our patients had pyonephrosis or infected hydronephrosis, requiring nephrectomy, who were too sick to withstand any major procedure. Nephrostomy as a preliminary measure can be done very easily here with the technique as outlined.

The kidney is usually markedly enlarged, often adherent to the surrounding tissues, close to the transversalis muscle and fascia, and is usually well walled off by perinephritis. Muscle splitting exposure of the lower pole and a stab wound for drainage will usually suffice. Occasionally the infected kidney consists of 2 or 3 separate pyonephrotic sacs which do not communicate, and which must be incised and drained separately. Better exposure can readily be obtained by cutting the upper angle of Petit's triangle upward to the rib and with upward traction of the rib the rest of the kidney is brought into view. The exposure can also be aided by cutting the latissimus and internal oblique for about 1 inch, at the posterior angle of the incision—this, however, is usually not necessary.

Eight of the 13 patients requiring two-stage nephrectomies improved with preliminary drainage, so that the kidney could be removed successfully at a later date. The postoperative course following the second stage nephrectomy was uneventful in all cases. Five did not survive—they were very sick patients whose general condition was bad when first seen. Seven of the 13 had calculous pyonephrosis. In 2 of these a number of large stones were easily removed through this small incision under local infiltration anesthesia.

One patient had a stone in the renal pelvis which had produced an acute block with associated severe renal infection. Her gall-bladder had been removed 2 weeks previously under a mistaken diagnosis. When it was discovered later that her chills and fever were due to a renal calculus with infection her condition had become grave. A simple nephrostomy was done very quickly under local anesthesia, and following this her condition improved rapidly. Three weeks later a recurrence of fever and chills made nephrectomy necessary. This was then done successfully and with an uneventful postoperative convalescence.

One patient with a congenital solitary kidney had anuria of 2 days' duration. The x-ray findings had been negative for stone. A nephrostomy tube was inserted and brought about improvement for a few days, but his condition gradually became worse; he died 10 days after operation. Necropsy revealed a number of large stones that were radio-translucent. At operation the kidney was under tension but showed no evidence of infection. Instead of the muscle splitting exposure it would have been best in this case to have made a wide exposure of the lumbar space and to have delivered the kidney. Careful exploration through a nephrotomy wound would have located the stones. These should have been removed at the time of operation. With stones left in the kidney, the presence of a tube may promote infection—or aggravate the already existent infection.

One patient had a badly infected kidney with apparently marked destructive changes, as shown by pyelogram. She was quite sick, and a nephrostomy was done at the time as a preliminary operation to a nephrectomy, which we planned to do later. She improved slowly at first, but after a period of 2 months, intravenous pyelograms showed a remarkable change. The kidney appeared almost normal! The tube was removed after a period of 3 months. Evidence of renal infection reappeared within a few days after this, and another nephrostomy was done. Another 2 months elapsed with a tube in the kidney, after which time the second tube was removed. She has been well since then. This patient has been seen frequently during the past 2 years. Her urine is still slightly cloudy, but she feels well. Repeated pyelograms appear normal, and her renal function on the side operated upon is good.

A frequent cause of chronic hydronephrosis, either unilateral or bilateral, is ureteral block due to extension from carcinoma of the uterus. These patients have already lost considerable weight and may be suburemic when this complication appears. Seven of our patients belonged in this group and were operated upon for temporary relief of the hydronephrosis. All operations were done very simply under local anesthesia. The general condition of these patients improved for only a short period of time or showed no change. No radical treatment of the carcinoma with either surgery or radiation was possible. All died within a period of 2 months.

One patient had hydronephrosis of one side with a constant dull ache in the loin which was due to postoperative pelvic adhesions, causing low ureteral obstruction. Repeated attempts at dilatation were unsuccessful and were usually

NEPHROSTOMY

Some Clinical and Experimental Observations

HARRY C. ROLNICK, M.D. Chicago, Illinois

THE most satisfactory drainage of the kidney is obtained with a tube inserted into the pelvis through the renal parenchyma. Nephrostomy affords rapid relief of the renal infection usually associated with ureteral obstruction and gives better drainage than either pyelostomy or ureterostomy. Some surgeons employ nephrostomy routinely following all conservative operations on the kidney. A nephrostomy tube is frequently left in place following pyelotomy for stone for the purpose of permitting better control of the associated renal infection and some drainage through the lower pole of the kidney must always be had to make possible a successful end result following plastic operations on the renal pelvis.

Chronic pyelonephritis which responds to no other form of treatment may occasionally be relieved by nephrostomy, and thus the sequel of pyonephrosis and atrophic pyelonephritis may be prevented.

The patient who requires the removal of a pyonephrotic kidney but is too sick to withstand nephrectomy, can have a preliminary nephrostomy to tide him over until it is safe to remove the kidney. A large number of our patients belonged to this group.

Chronic unilateral or bilateral hydronephrosis due to low ureteral obstruction may be relieved temporarily by nephrostomy. Following this an attempt can be made to free the ureter from the postoperative scar or adhesions secondary to chronic pelvic or adnexal inflammation.

Nephrostomy is indicated as a temporary measure following accidental ligation or cutting of the ureters in pelvic operations, particularly if the injury is bilateral. If the ureteral injury is diagnosed early enough—within the first 48 hours—and the condition of the patient permits, the abdomen should be reopened and the ureteral damage repaired. This is not a simple task and usually requires the aid of the urologist with the cystoscope in the bladder and ureteral catheters inserted in order to locate the ureters. However

considerable time may elapse before a decision is made to relieve the patient of her anuria or the urinary extravasation and she may then be too sick to withstand further abdominal exploration. It is here that nephrostomy, done quickly and with a minimum of trauma, acts as a life saving measure.

The technique commonly recommended for nephrostomy requires a muscle cutting lumbar exposure and delivery of the kidney. A small opening is then made in the pelvis and a forceps inserted through this opening and brought out through the lower pole of the kidney. A small mushroom catheter is then carried back to the pelvis with the withdrawal of the forceps. However, nephrostomy is often necessary for sick patients who cannot tolerate the rather extensive operation of wide lumbar exposure and delivery of the kidney. Nephrostomy, just as cystostomy should be a minor procedure, and it can be done equally as simply, and with very little discomfort to the patient.

During the past 4½ years we have done 8 nephrostomies successfully through a simple muscle splitting lumbar exposure of the lower pole of the kidney. Twenty four of these were done under local infiltration anesthesia. In this operation as shown in the accompanying illustrations (Figs. 1, 2, 3, 4) excellent exposure of the lower pole of the kidney is obtained in all cases. This is all that is necessary. The kidney is left *in situ* and is not delivered. A stab wound is then made in the lower pole through to the pelvis. This is followed by the insertion of an No. 18 or No. 20 catheter, preferably a mushroom into the pelvis through this opening. Hemorrhage is readily controlled by the catheter in place. Hemostasis is aided by a small packing placed loosely around the tube. In 2 instances a superficial suture through the capsule on either side of the tube was necessary to control bleeding. The various steps of this operation are shown here. The incision is parallel to and just below the rib and about 6 inches long. The kidney need not be elevated high.

Exposure is simple and can be done in most cases under local infiltration anesthesia. Occasionally the peritoneum must be retracted for ward gently for the exposure at Petit's triangle.

From the Department of Urology, Cook County Hospital and the Departments of Urology and Ca-ro-Intestinal Research at Michael Reese Hospital.

Presented before the Chicago Urological Society, November 18, 1937.

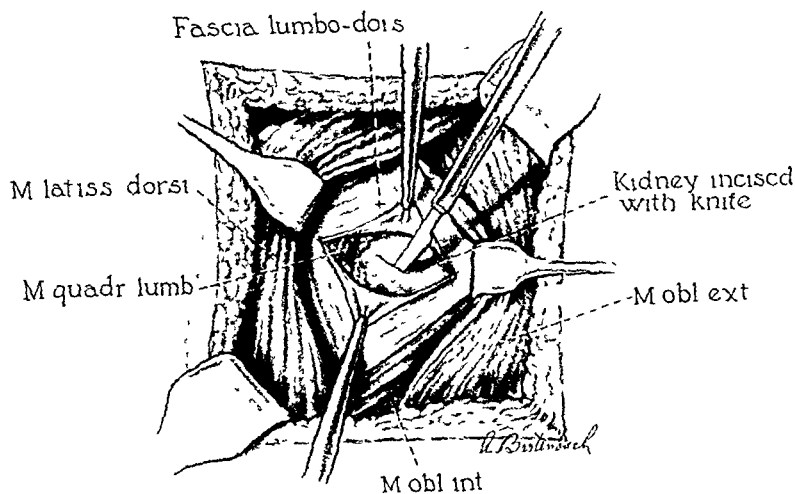


Fig 3

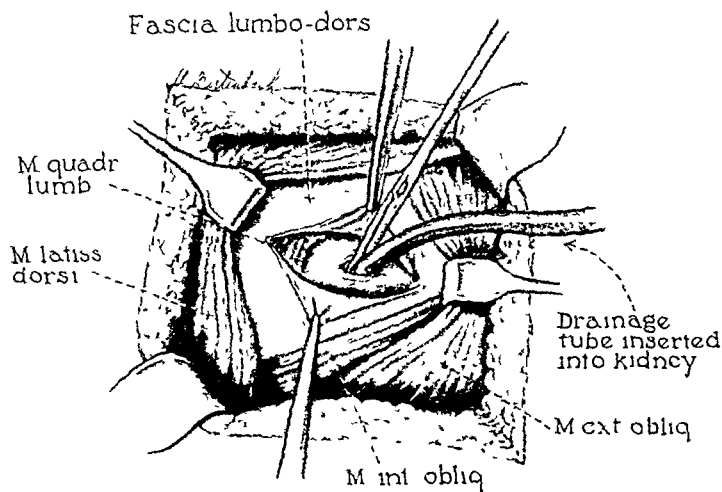


Fig 4

followed by fever of a few days' duration. Nephrostomy was then done. A few weeks later it was found possible to pass a small ureteral bougie after a rather prolonged session at the cystoscopic table, and with no postcystoscopic febrile reaction. This dilatation was then repeated at short intervals, and the nephrostomy tube was removed. When last seen there was no evidence of hydro-nephrosis, and she felt well.

Four patients had the ureters ligated or cut during pelvic operations. One patient was seen 9 days after operation. She had been passing some urine through the vagina, but she had a rather high fever and was uremic. She died the same day without operation. In another patient, seen 6 days after operation, a nephrostomy was done, but she expired 2 days later. Nephrostomy was done on one side only because the condition of the

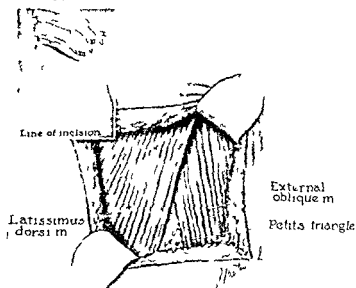


Fig. 1

Figs. 1, 2, 3, and 4. Various steps of nephrostomy with a muscle splitting exposure of the lower pole of the kidney. The kidney is not delivered. This can be done under local infiltration anesthesia. Fig. 1. First step. Fig. 2. Muscle splitting operation. Fig. 3. Lower pole exposed and stab wound made with kidney *in situ*. Fig. 4. Nephrostomy completed.

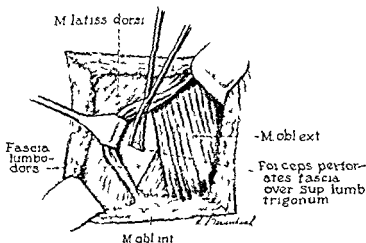


Fig. 2

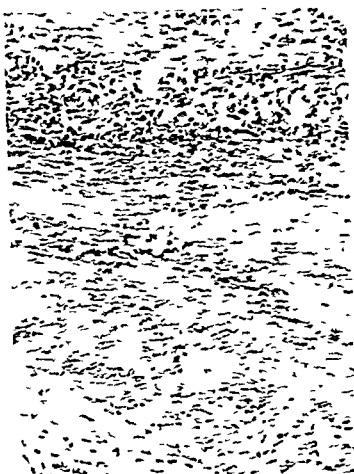


Fig 6



Fig 7



Fig 8

Figs 6 and 7 Marked fibrosis and replacement of kidney tissue by scar 2 and 3 months following insertion of deep mattress sutures experimentally in the dog's kidney

Fig 8 The renal vein was clamped for a period of 15 minutes and the kidney removed 3 weeks later Note degenerative changes still present

A patient who had been stabbed in the loin developed profuse hematuria immediately afterward, but the urine had already begun to clear after a few hours. She continued to bleed, however, from the stab wound, and was operated upon upon exposing the kidney we found that a clot had formed in the clean stab wound in the kidney, and complete hemostasis had resulted. The external bleeding was due to muscle injury which was readily controlled. We had here a clinical experiment showing that suture of the kidney is not necessary for hemostasis.

However, it would not be wise to depend merely on temporary compression of the nephrotomized kidney for permanent hemostasis. If the edges of the wound can be kept rather firmly together, excellent control of the bleeding can be had, and one can then feel quite sure of the hemostasis. We have found both clinically and experimentally that superficial sutures through the cut edges of the capsule running through the parenchyma on the surface, with or without the implantation of muscle or fat in the suture line, are all that is necessary to accomplish this purpose.

It is not necessary to employ deep mattress sutures. Deep sutures can do considerable harm. Constriction of the blood supply to the portion of the kidney incorporated in the mattress suture causes some necrosis from which bleeding may ensue. This is probably a major cause for late nephrotomy bleeding. It is not a rare experience to have a simple nephrotomy for a small stone followed by bleeding 2 weeks later which almost

exsanguinates the patient. The late effect of necrosis and slough due to interference with the local blood supply of the area incorporated in the mattress suture is the formation of scar tissue. In the experimental animal, large areas of fibrosis in the center of the area incorporated in the mattress suture can be noted grossly when these kidneys are examined later. Much scarring and destruction ensues, as shown by the accompanying photomicrographs of sections of kidneys in which mattress sutures had been placed 2 (Fig 6), and 3 (Fig 7) months previously.

We have had occasion to re-operate upon 2 patients who had nephropexy 18 months previously in each case. The method of nephropexy consisted of carrying a No. 2 doubled chromic catgut suture through the lower pole of the kidney, and then firmly attaching it to the twelfth rib. The kidney was held firmly and well up in good position at the second operation 18 months later, but the lower pole showed considerable change grossly due to fibrosis. It is doubtful whether ligation of even a large aberrant vessel in the treatment of hydronephrosis—a procedure which is often controversial—can produce much more damage than noted in these 2 cases.

Temporary control of bleeding during the operation is usually obtained by compression of the kidney with one hand. In 2 cases in which we removed encysted cortical stones, the bleeding vessels which could be readily seen at the margin of the parenchyma and cyst wall were clamped and then ligated.



Fig 5 Photomicrograph showing section of area in the kidney of a dog in which a nephrostomy tube had been left in place for 8 days and the kidney removed 3 months later. There is some fibrous tissue which had formed in a portion of the tract of the nephrostomy wound but the rest of the kidney remained normal.

patient did not permit much surgery. It is possible that if seen earlier a bilateral nephrostomy which was indicated could have carried the patient through.

One patient had anuria of 3 days duration, but did not appear sick. Attempts at passing ureteral catheters were unsuccessful. The next day, however, some urine appeared in the bladder and from then on she excreted large quantities of urine. The anuria was due probably to ligatures around both ureters which became loose after a few days and the patency of the ureters was then restored. It would not be safe to wait a longer period before again operating in the hope that a happy end result such as this would be the sequel.

Another patient had both ureters ligated. Four days later abdominal exploration was successful in partially deligating the left ureter but the right ureter was torn in the attempt to remove the ligature. The torn ureter could not be sutured but some of the defect was repaired by covering the posterior peritoneum over it. She was seen by us 7 days after the second operation and 11 days following the first pelvic operation. She had been passing small quantities of urine from the bladder for 5 or 6 days. She was very sick, however, and her abdomen had gradually become markedly distended. The lumbar space was exposed under local anesthesia on the side where the ureter had been torn during the second operation. The peri-

toneum bulged somewhat into the wound, and it was opened before attacking the kidney. About 3000 cubic centimeters of urine escaped from the wound. Nephrostomy was then done and the peritoneum was closed. This patient had a slow convalescence but with it a progressive recovery. It is interesting to note the ability of the peritoneum to tolerate large quantities of urine for a long period after intraperitoneal rupture of the bladder and surgical injuries to the ureter.

We re-opened the abdomen 6 weeks later and attempted repair of the torn right ureter. Approach was very difficult because of adhesions and distortion of the ureter. It was found, however, that the defect in the ureter had been bridged over during this interval of diversion of the urine apparently with the aid of the posterior peritoneum and thus the continuity of the ureter was restored. This was a rather fortunate end result, for late repair of ureteral injuries is often very difficult and may be unsuccessful. An attempt to repair a ureterovaginal fistula in another patient was unsuccessful because of a dense scar to which the iliac vessels were adherent. Nephrectomy of the involved side became necessary later.

We performed a number of nephrostomies on dogs, but were able in only 2 of our experiments to prevent the dog from pulling the tube out within the first 24 or 48 hours. The tube was removed 8 days after operation in both of the dogs we had been able to control and the kidney then removed 4 weeks later in one, and 3 months later in the other. The wound in the kidney was difficult to locate 3 months after operation. Sections from this kidney show some scar on the surface and some fibrosis in the tract of the nephrostomy (Fig. 5), but nowhere else. Except for this the rest of the kidney is normal. It is evident, therefore, that very little injury to the kidney results from the nephrostomy. Considerable clinical evidence has demonstrated that the severely infected kidney frequently returns to normal following the relief of obstruction and drainage. This is particularly true following open drainage by nephrostomy and is evidenced within a few weeks after operation by a return to the normal pyelographic outline and normal renal function.

We did a large number of simple nephrotomies on dogs for the purpose of determining the best method of hemostasis following incision into the renal parenchyma. Complete hemostasis resulted following simple apposition and compression for a few minutes of the 2 halves of the nephrotomized kidney. This was reported some years ago by Carson and Goldstein.

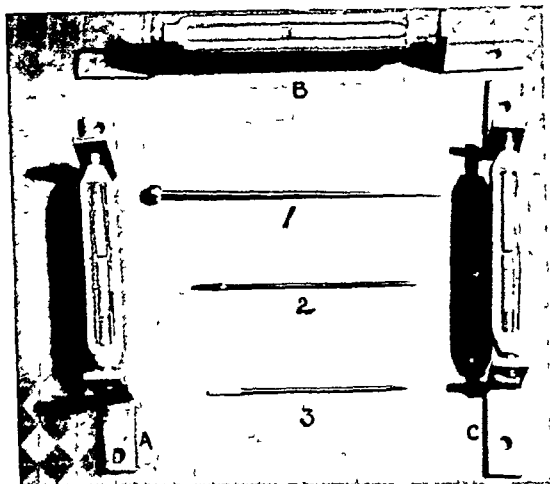


Fig 1 A, B, C, Three turnbuckles fitted with right angle ends, 1, Wyeth bone pin, 2, 3, different length Steinmann pins

surgically prepared and draped with sterile towels and sheets as needed. A 7 to 8 inch incision is made either to the inner or outer side of the crest of the tibia so the suture line will not be over the crest. At this stage an oblique osteotomy of the fibula is done through a separate lateral incision or through the original incision. The sides of the tibia are freed of all soft tissue for almost the length of the incision and a circular motor saw cuts longitudinally down the middle of the tibia



Fig 3

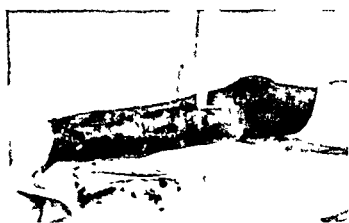


Fig 4

Fig 3 Dark line shows direction of osteotomy of tibia and fibula

Fig 4 Shows Steinmann pin in lower and upper ends of tibia and the suspension of leg to bracket above



Fig 2 Pin through os calcis, sterile muslin strip over each projecting end. The strips are crossed and tied to crossbar of foot piece. Patient on Hawley table

for 5 to 7 inches. A chisel or saw, depending on the accessibility, cuts the lateral half of the tibia at the distal end of the longitudinal cut, and then the medial half of the tibia at the proximal end of the longitudinal cut (Fig 3). The periosteum is divided at the same level as the last two cuts and then the fascia is cut according to indications presented.

The circular saw does not entirely cut through the posterior tibial cortex in the longitudinal cut, so a thin chisel completes this bone cutting. A short Steinmann pin is now placed through the lower portion of the tibia and then a second and longer one is driven through the tibia just below the tuberosity (Fig 4).



Fig 5 Anterior view looking from above knee toward foot. Each lateral turnbuckle is turned in a horizontal plane and the anterior one in a vertical plane. Note incorporation of bone pins and turnbuckles in cast.

Various measures are recommended for temporary control of hemorrhage during nephrotomy, such as a rubber band, or a clamp about the pedicle. However, even temporary interference with the blood supply to the kidney may cause considerable cellular change which requires many weeks for regeneration.

Physiologists are well acquainted with the fact that compression of the venous circulation is most damaging to an organ passive congestion interfering with oxidation and rapidly producing degenerative changes particularly as result of increased pressure and tension within the organ. Thus clamping of the renal vein for 15 minutes caused degenerative changes from which the kidney had not entirely recovered 3 weeks later as shown in Figure 8. Temporary clamping for 15 minutes of the entire pedicle, together with the ureter, is less damaging than clamping of the vein alone, and clamping of the renal artery alone is least damaging of these procedures.

These observations are not new. It is interesting to note that when the vein alone is clamped the kidney becomes blue, very tense and hard, and

actually increases in size. When the artery alone is clamped the kidney becomes soft and pale and shrinks in size to almost one half that of the normal kidney (2).

CONCLUSIONS

1 Nephrostomy can be done very simply through a muscle splitting lumbar exposure of the lower pole of the kidney. Local anesthesia will suffice in most cases.

2 Nephrostomy causes very little permanent injury to the kidney.

3 Deep mattress sutures should not be used for hemostasis in kidney surgery.

I am indebted to Dr. H. Neeheles for his valuable aid and suggestions to Dr. M. Appel for his aid in reviewing the histologic sections and to Miss Garvin for her aid in preparing the microscopic sections.

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TIBIA AND FIBULA LENGTHENING BY THE FURNBuckle METHOD

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SINCE November 8, 1932 there have been 37 bone lengthening operations done at the Nebraska Orthopedic Hospital, Lincoln, Nebraska. In 2 of these cases the femur as well as the tibia and fibula was lengthened. The lengthening was done 22 times on the left leg and 15 times on the right. All patients were under 17 years of age.

Thirty-two shortenings were from the results of poliomyelitis, 1 from fracture, 1 from cystic bone disease, 1 from tuberculosis of the hip, and 2 from a congenital anomaly.

Outside of the regular operating instruments only a few definite tools are needed (Fig. 1) such as (1) 3 steel bone pins, (2) 3 turnbuckles fitted with right angle ends, (3) an orthopedic table or traction frame, (4) a circular or other satisfactory bone saw.

From the Surgical Clinic of the Nebraska Orthopedic Hospital, Lincoln, Nebraska.

The main steps of the operation are carried out in the following order:

1 Insertion of pin in os calcis and suspension of patient on the table (Fig. 2).

2 Osteotomy of the fibula (Fig. 3).

3 Osteotomy of the tibia (Fig. 3).

4 Insertion of a pin in lower and upper ends of tibia (Fig. 4).

5 Incorporation of steel pins and three turnbuckles in leg part of a double synta cast (Fig. 5).

The method as employed at the Nebraska Orthopedic Hospital consists essentially of the following:

The patient is suspended on the Hawley table in the customary way, except that a sterile Wirth or Steinmann pin is driven through the os calcis of the leg to be lengthened and a sterile muslin strip is placed over each projecting end of the pin, is crossed and is tied tightly to the cross bar at the base of the footpiece (Fig. 1). The leg is

buckle is essential to insure stability and prevent slight motion or play. It is not necessary for the ends of the turnbuckles to be against the projecting ends of the bone pins, and it is easier to place them correctly if this is not attempted. It will be remembered that the pin ends are all held solidly in the cast, and any force applied on the leg cast also transmits the same force to the pins. The plaster bandages encircling the leg at the operative site need to be only of four or five layers (Fig. 6), as in the mid-area a circular cut is made on the third postoperative day so the upper and lower cuffs may separate as the turnbuckles are turned (Figs. 5 and 6). In order to control the leg adequately, a double spica or double leg cast is applied.

POSTOPERATIVE LENGTHENING OF THE LEG

Turning of the closed turnbuckles is started on the fourth postoperative day, and one to two full turns are accomplished each day thereafter until the desired length is reached and checked by x-ray examination. Making one-half or more turns twice a day is less annoying to the patient, and is carried out whenever possible to do so. By the last method mentioned, very little discomfort was experienced by the largest number of the patients. The two lateral turnbuckles are turned equally at the same time, and then the anterior one is turned an equal distance. By so doing, the original alignment is usually maintained (Fig. 7). If the right direction is not maintained by the tibial shaft, one or two turnbuckles can be turned separately or combined to make the correction.

It usually takes from 17 to 27 days to accomplish the desired length, which varies from 1 5 to 2 25 inches. It is usually difficult to get over 2 inches, and only in a few cases is it attempted, and then when conditions are favorable. The cast is left on 4 to 6 weeks after the turning is stopped, but the pins are removed in 4 weeks. A protective single leg cast is applied for another 4 to 6 weeks, depending on the extent of bone repair, and then a walking caliper is used for 2 to 3 months. In cases of very small spindle like bones, the caliper should be worn as long as conditions demand its use.

RESULTS

The results were satisfactory in the large majority of these cases. In 4 cases the full desired length was not obtained, but as minor details of technique were corrected, a more uniform length-

ening was obtained, and in no case was it more than 2 25 inches. In the majority of cases 1 5 to 2 inches was obtained. In the patient with the congenital shortening of the femur and tibia, a total increase in length of 4 75 inches was obtained, 2 5 inches in the femur, and 2 25 inches in both tibia and fibula.

CONCLUSIONS

1. A simplified turnbuckle procedure for lengthening of the tibia and fibula is presented which can be used by a large number of bone surgeons. With slight modifications the same procedure may be used for other bone lengthenings, such as the femur. The overlapping of tibial fragments in leg fractures may be handled in a similar manner, and thus correct alignment attained. The same turnbuckle extension principle is also used in pulling down high dislocations of congenital hips.

2. The apparatus necessary for this method of lengthening is inexpensive, easy to obtain, and readily controlled.

3. The two lateral turnbuckles and tibial bone pins furnish the necessary traction and counter-traction to the bone and soft tissue, and the anterior turnbuckle controls displacement in the anteroposterior direction. Two steel pins placed several inches apart in the upper tibial fragment will further prevent anterior displacement whenever this may be thought to be necessary.

4. By this method it is unnecessary to lengthen the Achilles tendon.

5. The results obtained are equal to any obtained from the use of more complicated and more expensive apparatus.

I acknowledge my indebtedness to Dr. H. Winnett Orr, chief visiting surgeon, for suggestions and the use of cases in making a report of this series of lengthenings.

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Fig. 6 Lateral view of turnbuckles and cast after turning is completed. Note separation of cast cuffs.

Two to three double strands of chromic catgut No. 3 are tightly tied equidistant about the split tibial shaft. The end sutures should be at least 1 inch from the cut ends of the tibial shaft and special care is taken to include no soft tissue in the sutures encircling the bone. The extension wheel to the foot attachment of the Hawley table is now tightened and some length is gained before the wound is closed by using chromic catgut for the fascia and plain catgut for the skin. Catgut is used for the skin so that the dressings need not be disturbed for the removal of sutures at a later date. The oftener dressings are tampered with

the more certain is infection to occur. A vaseline gauze strip covers the entire suture line and favors seepage of serum and tissue fluids and thereby lessens swelling. Sterile dressings are placed over the vaseline gauze, and then sterile sheet wadding is wound about the leg and pins. A sterile muslin strip is looped over each projecting end of the proximal tibial pin and tied to the overhead swinging bracket (Fig. 4). These strips should be tight enough to release the tension on the original muslin strip in case one is used supporting the knee in a slightly flexed position.

Cotton sheeting is wound about the leg and felt pads are placed at the customary areas needing protection. Plaster of Paris bandages encircle the leg and at convenient turns are wound about the respective ends of the pins in the upper and lower ends of the tibia and os calcis so as to anchor them firmly in the cast. After one half of the customary thickness of a leg cast is applied and the plaster starts to be a little firm, a turnbuckle is placed slightly over half way down on each side of the leg and one on the anterior surface (Figs. 5 and 6). The ends of the three turnbuckles must be firmly incorporated in the outer layers of the cast and be equidistant from each other in the longitudinal planes (Fig. 5). The anterior turn-

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Fig. 7

Fig. 7 Anterior and lateral roentgenograms of tibia and fibula 3 months after lengthening operation. The arrows indicate the amount of lengthening and the extent of the repair.



Fig. 8

Fig. 8 Anterior and lateral views of tibia and fibula 10 weeks after lengthening operation.



Fig. 9

Fig. 9 Anterior and lateral views of tibia and fibula 3 months after lengthening operation.

increased, the discomfort was maximal on pressure over the proximal half of the second metatarsal bone. There was no pain over the first and fifth metatarsal bones. Twenty days later a firm lump made its appearance, corresponding to the region of the greatest tenderness. Roentgenologic examination gave evidence of a mass which was the result of the formation of callus around a fracture. In 1899 Thiele reported on 17 cases which occurred in a single battalion in $3\frac{1}{2}$ months. On roentgenologic examination 15 of these patients gave evidence of fracture. He considered the lesion to be the result of indirect force and drew attention to what he claimed was the sequence of events in this condition. He claimed that prolonged flexion of the bones led to an inflammatory reaction and in cases in which the force continued to act a fracture occurred. Momburg, writing in 1904, agreed with this conception of an inflammatory reaction leading to proliferation and subsequent fracture when the strain continued. He performed roentgenologic examination of the feet of many soldiers who made no complaints referable to the feet and he demonstrated silent periosteal proliferations of the second and third metatarsal bones in several of the cases. Kirschner, in 1905, when reporting on 82 patients, agreed with Schulte and Runstrom that in all cases the condition resulted from fractures or inflections, which were perhaps not noticed at first but, he said, if careful re-examination were carried out his claim would be confirmed. He considered that all such conditions followed exhaustion of the muscles of the foot. Physicians are indebted to Baehr, 1913, for his study of the mechanics of fracture.

Deutschlaender, in 1921, in his second contribution to the study of this subject, suggested a bacterial factor in the etiology of this condition. His views were based on 6 cases in all of which the patients were women. In 3 cases there was fever of low grade, formation of callus, which normally was present in 3 to 4 weeks, did not appear until the ninth week. He considered that the cause in those 3 cases was hematogenous bacterial periostitis of low grade. Although Deutschlaender's name has been given to march foot because of his early work on the subject, research has shown that Breithaupt was the original investigator in this field. Trethowan in 1921, and Jones and Lovett in 1923, in treatises on orthopedic surgery, referred to march foot as *pied forcé*.

Thalwitzer considered that march foot was caused by periostitis and that fractures were present only when demonstrated. Tobald, in an

analysis of 1500 cases, found fracture in 49.7 per cent, periostitis in 11.9 per cent, old fracture in 5.7 per cent, and no fracture in 32.7 per cent. Blecher, in an investigation of 78 patients, was the first to draw attention to recurrences of old fractures. He reported 2 cases in which fracture had recurred for a third time. Speed and Blake also grouped their cases into (1) those in which there was no tumor, roentgenologic findings were negative, and recovery was complete in 7 to 10 days, and (2) those in which the duration of symptoms and disability were prolonged, lasting 3 months, callus was excessive, and a fracture line was usually, but not always, seen.

Perhaps the most acceptable view is that of Zeitlin and Odessky, who concluded that march fracture occurred as a result of overloading a foot already weakened functionally and anatomically. The number of hypotheses advanced to explain this condition indicates the uncertainty which still shrouds its origin. Inflammatory factors doubtless are present in a small proportion of cases. In others, neurogenic influences probably play their part, but without doubt in the great majority of cases the condition is the result of trauma of greater or lesser degree to feet of which the functional sufficiency is well below par.

Honigsmann drew attention to the similarity between this fracture and that which occurred in states of starvation, the so called spontaneous fracture. Turner invoked the influence of a trophoneurotic factor, while Blencke blamed high heels. It is to Jansen, who described 6 cases, that physicians owe the enunciation of the circulatory explanation, a view shared by Narvi. In 1926 Jansen suggested that spasm of the interosseous muscles led to hypertrophy of the muscle tissue and of the periosteum. Subperiosteal hemorrhages followed, he said, and this resulted in partial absorption of the bone, with resultant increase in brittleness and susceptibility to fracture. In substantiation of this claim he pointed out that periosteal changes never were noticed on the outer border of the fifth metatarsal or on either border of the first metatarsal bone, the only regions from which the interossei do not arise. The Sloanes considered that flat feet led to secondary disturbances of circulation of the foot, increased brittleness of bone and an increased tendency to fracture. Dodd claimed that a short first metatarsal bone, by throwing the foot into pronation and bringing the stress and strain of weight-bearing on the second metatarsal bone, was the predominating factor. Meiser's views are in concord with those of Dodd, while Morton's four points give additional support to Dodd's

MARCH FRACTURE

Deutschlaender's Krankheit, Marschgeschwulst, Fussgeschwulst,
Marschfraktur, Fracture-de-Recrue, Pied Deble, Pied Force,
Pied de Marche, L'Enflure du Pied, Pied Surcharge

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THE dictates of extreme fashion in modern footwear, the sedentary habits to which most of us too easily submit and the ubiquity of an overdeveloped transportation service, all have contributed to lowering of the normal muscular tone of the American people to such an extent that complaints concerning the feet today are among the commonest heard by members of the medical profession. When to the aforementioned factors is added the casualness with which the average physician regards what to him is a minor malady there is at hand one of the main causes for the flourishing state of extraprofessional groups. We would suggest therefore that the practitioner consider march fracture as a possible diagnosis in every case of painful feet in which a complaint is made of sudden onset of symptoms following unaccustomed and excessive exercise.

Most of the literature on this subject has come from the pens of European authors engaged in the care of soldiers whose daily lot was excessive marching and weight bearing. A lesion which is likely to be confused with malignancy but which can be recognized and which does respond to treatment should be of interest to every practicing physician.

The credit for the original description of what is now recognized as march fracture must be given to Breithaupt. In 1855 this German military surgeon reported on several cases of persistently edematous and painful feet occurring in soldiers following forced marches. To this condition he applied the name *Fussgeschwulst*. From his observations he was of the opinion that the condition was the result of an inflammatory reaction in the tendon sheaths traumatic in nature and a direct sequel of the untoward strain to which certain feet were subjected during a march. In 1877 Weisbach described a similar condition which evinced itself 2 to 3 days following a route

march. Although he agreed with Breithaupt's opinion regarding the etiology, Weisbach considered that the pathological lesion affected the ligaments rather than the tendons and their sheaths and applied the term *syndesmus melatarsae*. In 1857 Pauzat as the original French investigator, put forward the hypothesis that the causal factor was to be found in the dorsal fold of the soldier's shoe. He believed that the first stage was that of simple swelling of soft tissue but that this was followed by periosteal proliferation, the sequel of irritation set up by the shoe fold resulting in definite osteoplastic perostitis. In 1888 Poulet, also speaking from his experience in the French army, suggested the "rheumatic diathesis, as the predisposing factor an hypothesis more in keeping with the trend of modern thought. Three years later, in 1891, Martin first suggested that the symptoms were produced by synovitis and arthritis of the joints of the fore part of the foot. He reported on three cases: (1) simple periostitis, (2) tendinitis alone and (3) perostitis complicating mediotarsal arthritis. A review of the whole subject was published in 1897 by Busquet in which he divided the cases into two categories: (1) traumatic and (2) diathetic but even in this latter group he admitted that whereas predisposition the result of some general condition might exist the localizing factor was traumatic. With the advent of roentgenology much that was pure hypothesis was swept away and in examination of 35 patients described by Stechow, who was the first to examine his patients by this method the lesion behind march foot was demonstrated to be fracture of a metatarsal bone. In the same year 1897 Schulte in reporting a series of 53 cases stated that in all the causal factor was a fracture. He described a typical case that of a soldier who after a long march returned to camp with a burning sensation in the middle portion of his right foot. The following morning in spite of a swollen foot he undertook an hour's march. Pain and swelling

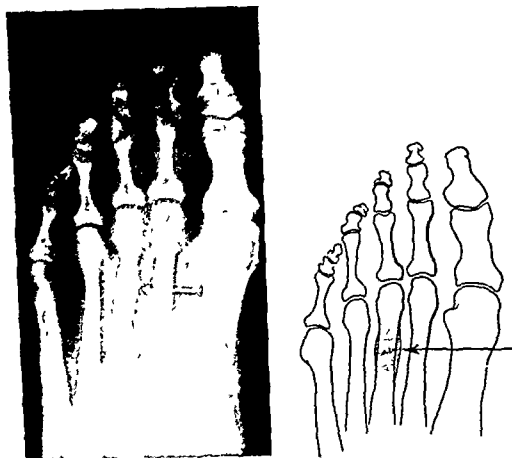


Fig 1, a and b The fracture passes transversely through the third metatarsal bone and callus

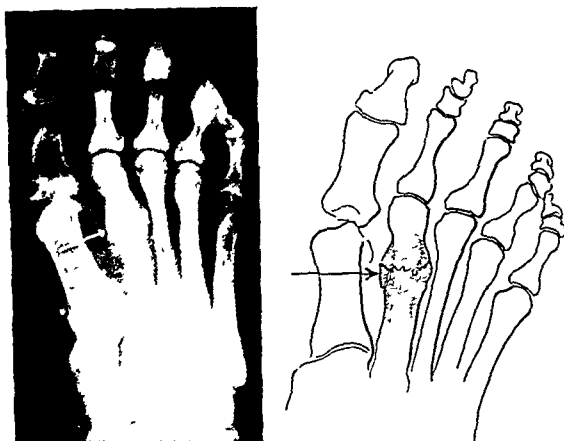


Fig 2, a and b Fracture of the second metatarsal bone and marked formation of callus in hypertrophied second metatarsal bone The head of the first metatarsal bone had been excised for hallux valgus

tion of fluid from irritation at the site of fracture, there is a gradual periosteal proliferation, which becomes roentgenologically evident after 3 weeks. This spindle-shaped periosteal formation in the shaft of the bone, with unrecognized fracture, has led to the erroneous diagnosis of sarcoma. It is interesting to consider Deutschlaender's findings in his report of 1921, on those cases of possibly infectious nature, wherein callus did not appear until the ninth week.

SYMPTOMATOLOGY

In the vast majority of cases the first symptom is an ache or burning pain in the fore part of the foot, for which the patient is unable to account. The discomfort may be felt only when weight is put on the foot, rest giving complete relief, but in other cases a dull ache is constantly present. In those cases in which the patients are soldiers, the pain occurs in the course of a march. In some such cases it is so severe that the men are unable to walk, in others, they are forced to lighten their equipment, while in others again, the discomfort is not very prominent and the men may even continue at their usual duties without much complaint. Swelling is present on the dorsal aspect in cases of minor degree, but in those in which symptoms are very marked, edema is obvious on both the dorsal and plantar surfaces. The edema is usually localized to the region which lies above the bones involved but in some cases it may extend up as far as the ankle joint. Ecchymosis is not present. In our series two patients had, in addition to pain and swelling, definite erythema over the dorsum of the foot.

In 5 cases of our series a history of trauma could not be elicited, even on pointed inquiry. In 3 cases a minor degree of trauma might have been a causal factor, for the pain of one patient developed in the course of a game of tennis; that of another, immediately on taking a forceful step forward, and a third admitted to a period of unusual exertion while she was on a camping holiday, in no case of the 3, however, was there any suggestion of definite direct injury. Another patient, a tall, slim young physician, said that before the onset of his pain he had been subjected to the excessive strain of overwork. For years he had worn arch supports. This would tend to confirm the opinion we hold that march foot afflicts those patients whose feet are already weak but are adequate until some sudden or long continued strain affects the weakest of the metatarsal bones and fracture results. Tenderness, with pain on walking at the site of fracture, is the most outstanding sign.

SEX AND AGES OF PATIENTS AND SITE OF FRACTURE

Although men are predominantly the victims, in our practice women have been more often afflicted with this condition. In our series 7 patients were women and 3 were men, their average age was higher than that usually reported; it was 39 $\frac{3}{4}$ years. The youngest patient was 19 years of age and the oldest, 61 years. In our group the left foot was involved in 4 cases and the right in 5, while in the tenth case fractures occurred in both feet. In this tenth case the second metatarsal bone of the left foot was frac-

claim, three of these points are that the first intermetatarsal space is prolonged backward, that the first metatarsal bone is short, and that posteriorly situated sesamoid bones at the head of the first metatarsal have virtually the effect of shortening the first metatarsal bone. These factors lead to the change which constitutes the fourth point, namely, compensatory enlargement of the shaft of the second metatarsal bone, but if hypertrophy is inadequate and the strain continues fracture is likely to occur.

March foot has been a subject of sporadic interest since its original description by Breithaupt. There have been definite cycles of interest alternating with periods when the literature has been devoid of even the briefest reference to the lesion. Originally considered to be exclusively one of the hazards of a military career it has more recently shown itself as a habit of ordinary civilian existence. Undoubtedly it is much more common among men who follow an active career such as that led by the average soldier who as a recruit may undergo forced marches and physical drill daily, but among traveling salesmen (Goldman) waitresses and shop attendants cases are far from rare. Although the fold of the shoe in the average military boot may be responsible for considerable discomfort the site of pressure does not uniformly correspond to the situation of periosteal proliferation and fracture found in examination of patients with march fracture. Muscular spasm with resultant circulatory interference, has been advanced as an explanation of many of those cases in which periosteal proliferation is found. However to account for the sudden fracture in association with which evidences of change in density of bone and periosteal hypertrophy are lacking on roentgenologic examination this explanation is hardly adequate.

From our personal experience and from a review of the literature of this type of fracture it would seem that the majority of the evidence points to the lesion occurring in those feet which are physiologically inadequate be the cause what it may, anemia, hypotonic muscles, short first metatarsal segment, and so forth. Continued and repeated strain, such as that sustained on a long route march or the stress and strain of excessive standing aggravated by the necessity of supporting extra weight may result in rupture of that metatarsal bone on which the greatest strain is placed. The comparative rarity of the condition among members of the general public probably is explained by the promptitude and ease with which the average person can rest when fatigued. It would be of interest to make and we propose to

carry out in the future a series of investigations of the concentration of calcium phosphorus, and phosphatase in the blood of victims of this lesion.

March foot might be defined as a fracture of the second or third or fourth metatarsal bones without known adequate cause. The condition most commonly affects the second metatarsal bone. Nyon in his series of 575 cases found the second metatarsal bone affected in 112, the third metatarsal bone in 98, and the fourth metatarsal bone in 17, the first was involved in 1 case only. In his entire series fracture was proved definitely to have occurred in only 128 cases. One cannot place too much reliance on the roentgenologic findings because not infrequently a bone at first roentgenologically negative, has been found on a roentgenologic examination made several weeks later, or at operation, to be fractured. Speaking generally, the first and fifth metatarsal bones are not affected. As a rule only one bone is affected but cases have been described in which two bones in the same foot have been involved and Saves described a condition in which the second and third metatarsal bones were affected on the right and the first and second metatarsal bones on the left. In our group one case is cited in which a similar bilateral involvement had occurred. The site usually is either the middle or the proximal third but in our patients the fracture occurred in the distal half of the metatarsal bone.

PREDISPOSING CAUSES

Predisposing factors include fatigue of the muscles and ligaments, circulatory interference and increase in weight, large, badly fitted shoes which do not support the fore part of the foot and flat feet. In short there is no single predisposing cause but a summation of several minor factors breaks down a natural resistance.

EXCITING FACTORS

Sudden quick steps and repeated subminimal trauma are the exciting causes. In most cases in which roentgenograms are made anteroposterior, lateral and oblique views will show a thin line of fracture in the shaft of the metatarsal without displacement but in an appreciable proportion of cases no solution in continuity of bone is seen. In many cases of this latter group however subsequent roentgenologic examination after 5 to 6 weeks will demonstrate the presence of a fracture. We believe that the periosteal proliferation results from constant irritation in an imperfectly immobilized fracture that is subjected to the stress and strain of weight bearing and motion. As a result of stripping of periosteum and collec-

negative roentgenograms, definitely should distinguish tenosynovitis from other conditions

One of us (Meyerding) had a case in which the patient's own physician reasonably enough had made a diagnosis of sarcoma and had advised immediate amputation. The question of march fracture arose but the other features were so much in favor of the more serious condition that a preliminary biopsy was decided on and at operation the simpler condition was proved to be present on microscopic examination of tissue. Dodd reported a case in which amputation was carried out, and it was not until the specimen was examined by a pathologist that the true nature of the tumor became apparent. Syphilitic periostitis can be excluded by flocculation tests, these are carried out routinely in all of our cases

TREATMENT

Via medicatrix natura is as potent a therapeutic factor in march fracture as it is in many of the other ills to which flesh is heir. No doubt many a soldier in times gone by was cured by time and rest alone. In this modern age, relief of pain is demanded by the soldier as vociferously as by the merchant, and no measures are more effective in relieving discomfort than rest, together with heat in the form of diathermy or infra-red light. Specially made arch supports are effective, as are splints of tongue depressors applied with adhesive tape. A wide toed, well fitted, heavy soled boot with an elevated, large, square heel, and the aid of a crutch or cane, enable the patient to get about with minimal discomfort. In certain cases in which the patient must continue at his work we have applied a plaster cast from the knee to the toes, with successful results.

REPORT OF CASES

In the cases which now are to be reported, relevant laboratory examinations of the urine and blood and other special examinations were made without disclosing anything that bore on the condition here discussed

CASE 1 A woman, unmarried and aged 33 years, reported for examination on June 18, 1936. Her height was 5 feet (152 cm) and her weight 126 pounds (57 kg). At the time of admission she complained of pain in the left foot of 7 to 8 months' duration and said that pain had come on following a game of tennis. She had been examined and roentgenograms had been made elsewhere some months previously, with negative findings.

At the time of our examination the general physical findings were negative and roentgenograms gave evidence of an old fracture of the left third metatarsal bone, with periosteal reaction mesially (Fig 1, a and b).

CASE 2 A butcher, aged 53 years, reported for examination on May 9, 1927. His height was 6 feet (183 cm) and

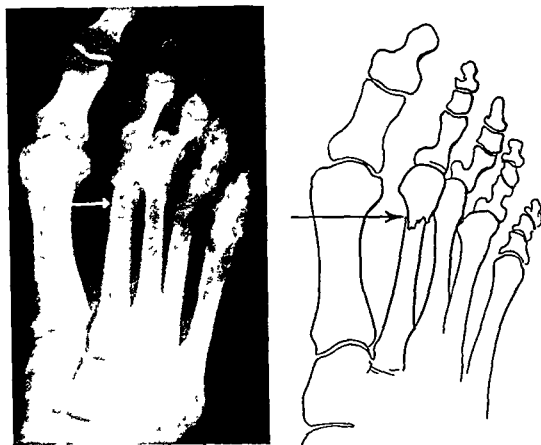


Fig 4, a and b Fracture of the distal third of second metatarsal bone of left foot, with slight displacement and without periosteal proliferation

his weight 150 pounds (68 kg). On admission he complained of pain in the left foot of 3 days' duration, but he did not give a history of trauma. He stated that pain had begun in the fifth toe, along the outer side of the foot, and that swelling had occurred and had extended to the right side of the ankle.

General physical examination gave negative results. Roentgenograms gave evidence of fracture of the proximal phalanx of the fifth toe of the left foot and of the shaft of the fourth metatarsal bone.

CASE 3 A housewife, aged 47 years, reported at the clinic in 1926, at which time her height was 5 feet, 7½ inches (171 cm) and her weight 174 pounds (79 kg). On admission she complained of attacks of swelling and pain of the dorsum of the right foot, of 2 months' duration. She attributed her symptoms to an operation for bunion that had been performed elsewhere 1 year previously. A history of trauma could not be obtained on inquiry.

Roentgenologic examination demonstrated that (1) the head of the first metatarsal bone of the right foot had been excised as a step in the treatment of her hallux valgus and (2) that a thickened second metatarsal bone had been fractured in its middle third, without displacement but with marked formation of callus (Fig 2, a and b and Fig 3, a and b). Our interpretation of the findings was that, as a result of excision of the head of the first metatarsal bone and the consequent shortening of this segment, pronation of the foot had occurred, throwing increased strain on the second metatarsal bone. Compensatory hypertrophy of the second metatarsal bone occurred but this was not sufficient to support the weight, as a result fracture occurred.

CASE 4 A woman, unmarried, and 50 years of age, reported for examination on November 11, 1928. Her height was 5 feet, 7½ inches (171 cm) and her weight 163 pounds (74 kg). She complained of pain, swelling and stiffness of the left foot when walking, of 6 months' duration. While she had been walking with a blister on the foot, she had noticed pain and swelling over the metatarsal bones. A history of trauma could not be elicited, but recently the patient had increased in weight.

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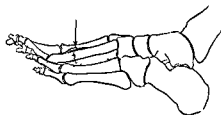


Fig 3 a and b Lateral views of same foot as that represented in Figure 2 a and b

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PROGNOSIS

The prognosis is uniformly good. In the early stages changes may not be noticeable but after 2 weeks periosteal fuzziness is distinctly discernible. By the third or fourth week exuberant callus is the rule although in Deutschlaender's latter series this was delayed until the ninth week. As the fracture heals the excessive callus is absorbed and after 6 months only residual thickness at the site remains as a clue to the preceding defect.

DIAGNOSIS

In any case of painful feet a history of over exercise of prolonged and excessive weightbearing or of the wearing of arch supports for weak feet

should especially in the absence of direct trauma cause the physician to think of march fracture and roentgenologic investigation should be carried out. The physician should not attribute the symptoms of pain, swelling or even fine crepitation to the simpler tenosynovitis. It must be borne in mind, however, that not infrequently the roentgenologic report may be negative for fracture. A practical point in examination of the roentgenograms is inspection of the films held at varying angles to modify the intensity of illumination; too brilliant light frequently masks the hair line shadow of the fracture. Furthermore an oblique view should be taken for in certain cases a hair like line of fracture invisible in the anteroposterior and lateral views becomes apparent in the oblique exposure. Even when all three views are searched carefully definite evidence of fracture cannot be seen in a certain number of cases yet in a roentgenogram made 4 weeks later the shadow of the line of fracture may be distinct. In Straus' case, periosteal overgrowth of the metatarsal bone was obvious but it was not until the bone had been removed at operation and sectioned longitudinally that the fracture became visible.

DIFFERENTIAL DIAGNOSIS

The only important conditions which are of concern here are (1) tenosynovitis and (2) osteogenic sarcoma. Straus reported a case in which the patient gave no history of trauma but in which a tumor was palpable in the shaft of the metatarsal bone and the roentgenograms disclosed the presence of a tumor but no fracture. The patient also complained of nocturnal pain and had lost appreciably in weight. We believe that when doubt exists as to the exact diagnosis biopsy should be carried out and the opinion of an expert pathologist should be obtained to clear the issue. Swelling, superficial pain, tenderness and local increase in temperature with repeatedly

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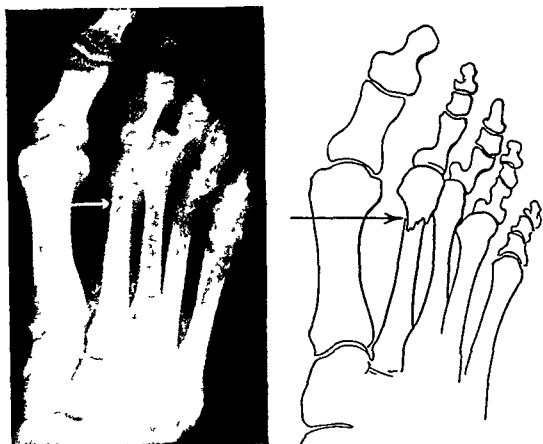


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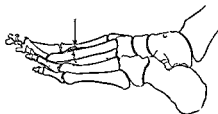


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(Fig 4, a and b) There was slight displacement of the fragments, without periosteal proliferation. The roentgenograms also disclosed the presence of a deformity of the head of the fifth metatarsal bone of the same foot, probably the result of an old fracture. As the patient insisted on working, a cast of plaster of Paris was applied to the foot and he returned to his work. Three weeks later, he returned to the clinic and was found to be very much improved and free from pain. At this time he recalled that while in the Army, in 1917, marching caused him to become disabled by pain in the left foot. For the 4 years before he came to the clinic he had been treated for bilateral claw foot and painful callosities. Arch supports and transverse metatarsal bars had been prescribed for these conditions and had given him some benefit.

CASE 10. A female nurse, in training and aged 19 years, was under observation for secondary anemia when she came to the office complaining of pain and tenderness along the dorsum of the right foot and of pain along the extensor tendons of the third right toe, of 3 days' duration.

Foci of infection were not found. The patient's height was 5 feet, $3\frac{1}{2}$ inches (161 cm) and her weight 108 pounds (49 kg). There was a moderate degree of bilateral flat foot. Crepitus could not be elicited on examination. The consulting orthopedic surgeon thought that the condition of the right foot was the result of tenosynovitis and strapped the foot. The woman felt better for 2 days following this and then the condition was worse and pain continued. Roentgenograms disclosed the presence of a subperiosteal fracture of the distal third of the third metatarsal bone, without periosteal thickening (Fig 5, a and b and Fig 6, a and b).

In all cases treatment by means of rest, heat, and splinting resulted in satisfactory recovery.

SUMMARY

We believe that march foot, although infrequently recognized in civilian practice, does occur and may be entirely overlooked or confused with tenosynovitis or sarcoma. In the differential diagnosis, we wish to emphasize the difficulty of recognizing the shadow of the hair-line fracture in roentgenogram. It is our belief that the periosteal proliferation results from irritation at the site of fracture, and is the result of imperfect immobilization. We believe that biopsy should be carried out when any doubt exists as to the true nature of the condition.

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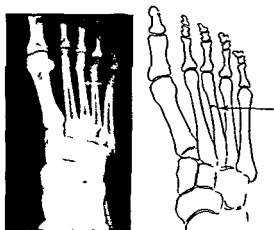


Fig. 5 a and b. Fracture of the distal third of third metatarsal bone.

at consultation a diagnosis of old fracture of the second metatarsal bone of the left foot was made; moreover evidence of a more recent fracture of the third metatarsal bone was found.

CASE 5. A female nurse aged 21 years, reported for examination on August 2, 1920. She complained of pain in the right foot and stated that 4 days previously while going upstairs, she had felt something "pop" in the region of the second toe. Hot fomentations and rest had resulted in relief of the condition but walking had aggravated it and caused more pain and swelling of the foot.

On examination diffuse swelling and tenderness over the second metatarsal bone of the right foot were found while on the plantar aspect of the head of the second metatarsal bone there were thick callusities. Roentgenologic examination disclosed the presence of a fracture of the second metatarsal bone. Eleven days subsequently roentgenologic examination gave evidence of slight displacement of the fracture and of exuberant formation of callus.

CASE 6. A male physician aged 34 years reported for examination on February 1, 1926. His weight was 164 pound (74 kg) and his height 5 feet 11 inches (180 cm.).

He gave a history of pain and swelling of the feet developing 4 months previous to his admission.

On examination of the roentgenograms it was found that a fracture involved the middle of the shaft of the second metatarsal bone of the left foot and there was suggestive evidence of an old fracture of the second and fourth metatarsal bones of the right foot. Multiple callusities and trichophytosis were found on examination of both feet. Further questions elicited the fact that the patient had been very active professionally, had overworked, and had become fatigued previous to the onset of his symptoms. He had worn arch supports for some time.

CASE 7. A woman aged 45 years, reported for examination on July 3, 1927. Her height was 5 feet 9 inches (175 cm.) and her weight 183 pounds (83 kg). She complained of pain, swelling and redness in the region of the fourth toe of the right foot of 1 month's duration. She said that the pain was present only when she walked and that recently she had gained weight. There was a history of the patient being unusually energetic while on a camping trip about a month previous to admission but she could not recall having sustained any direct trauma.

Roentgenograms disclosed the presence of a fracture of the third metatarsal bone of the right foot.

CASE 8. A man aged 61 years, reported for examination on June 16, 1925. Her height was 5 feet 4 inches (163 cm.) and her weight 124 pounds (56 kg). She complained of pain in the right foot of 3 to 4 days' duration. She recalled that she had experienced pain while she was very active looking after children and had taken a forceful step forward beyond this there was no history of trauma to the foot.

Examination disclosed tenderness and swelling of the fore part of the right foot with increased local tenderness and pain of the outer side. The patient formerly had worn rubber arch supports but for the past 2 months she had worn steel supports. Roentgenograms gave evidence of a fracture of the proximal end of the fourth metatarsal bone. Additional findings were bilateral hallux valgus with marked callus of both feet.

CASE 9. A merchant aged 48 years, reported for examination December 5, 1923. His height was 5 feet 10½ inches (179 cm.) and his weight 180 pounds (82 kg). He complained that 1 week previously without preceding illness or injury he had been seized with pain and swelling in the fore part of the left foot. He said that he had been on his feet a great deal preparing his shop for Christmas.

Roentgenograms gave evidence of a fracture of the distal third of the second metatarsal bone of the left foot.



Fig. 6 a and b. Lateral views of same foot as that represented in Figure 5 a and b.

(Fig 4, a and b) There was slight displacement of the fragments, without periosteal proliferation. The roentgenograms also disclosed the presence of a deformity of the head of the fifth metatarsal bone of the same foot, probably the result of an old fracture. As the patient insisted on working, a cast of plaster of Paris was applied to the foot and he returned to his work. Three weeks later, he returned to the clinic and was found to be very much improved and free from pain. At this time he recalled that while in the Army, in 1917, marching caused him to become disabled by pain in the left foot. For the 4 years before he came to the clinic he had been treated for bilateral claw foot and painful callosities. Arch supports and transverse metatarsal bars had been prescribed for these conditions and had given him some benefit.

CASE 10 A female nurse, in training and aged 19 years, was under observation for secondary anemia when she came to the office complaining of pain and tenderness along the dorsum of the right foot and of pain along the extensor tendons of the third right toe, of 3 days' duration.

Foci of infection were not found. The patient's height was 5 feet, $3\frac{1}{2}$ inches (161 cm) and her weight 108 pounds (49 kg). There was a moderate degree of bilateral flat foot. Crepitus could not be elicited on examination. The consulting orthopedic surgeon thought that the condition of the right foot was the result of tenosynovitis and strapped the foot. The woman felt better for 2 days following this and then the condition was worse and pain continued. Roentgenograms disclosed the presence of a subperiosteal fracture of the distal third of the third metatarsal bone, without periosteal thickening (Fig 5, a and b and Fig 6, a and b).

In all cases treatment by means of rest, heat, and splinting resulted in satisfactory recovery.

SUMMARY

We believe that march foot, although infrequently recognized in civilian practice, does occur and may be entirely overlooked or confused with tenosynovitis or sarcoma. In the differential diagnosis, we wish to emphasize the difficulty of recognizing the shadow of the hair-line fracture in roentgenogram. It is our belief that the periosteal proliferation results from irritation at the site of fracture, and is the result of imperfect immobilization. We believe that biopsy should be carried out when any doubt exists as to the true nature of the condition.

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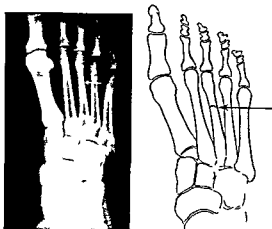


Fig 5 a and b Fracture of the distal third of third metatarsal bone

at consultation a diagnosis of old fracture of the second metatarsal bone of the left foot was made; moreover evidence of a more recent fracture of the third metatarsal bone was found.

CASE 5 A female nurse aged 21 years reported for examination on August 2, 1920. She complained of pain in the right foot and stated that 4 days previously while going upstairs she had felt something "pop" in the region of the second toe. Hot fomentations and rest had resulted in relief of the condition but walking had aggravated it and caused more pain and swelling of the foot.

On examination diffuse swelling and tenderness over the second metatarsal bone of the right foot were found while on the plantar aspect of the head of the second metatarsal bone there were thick callosities. Roentgenologic examination disclosed the presence of a fracture of the second metatarsal bone. Eleven days subsequently roentgenologic examination gave evidence of slight displacement of the fracture and of exuberant formation of callus.

CASE 6 A male physician aged 34 years reported for examination on February 1, 1936. His weight was 164 pound (74 kg) and his height 5 feet 11 inches (180 cm).

He gave a history of pain and swelling of the feet developing 4 months previous to his admission.

On examination of the roentgenograms it was found that a fracture involved the middle of the shaft of the second metatarsal bone of the left foot and there was suggestive evidence of an old fracture of the second and fourth metatarsal bones of the right foot. Multiple callosities and trichophytosis were found on examination of both feet. Further questions elicited the fact that the patient had been very active professionally had overworked and had become fatigued previous to the onset of his symptom. He had worn arch supports for some time.

CASE 7 A woman aged 48 years reported for examination on July 5, 1927. Her height was 5 feet 9 inches (175 cm) and her weight 183 pounds (83 kg). She complained of pain, swelling, and redness in the region of the fourth toe of the right foot of 1 month's duration. She stated that the pain was present only when she walked and that recently she had gained weight. There was a history of the patient being unusually energetic while on a camping trip about a month previous to admission but she could not recall having sustained any direct trauma.

Roentgenograms disclosed the presence of a fracture of the third metatarsal bone of the right foot.

CASE 8 A nun aged 61 years reported for examination on June 16, 1923. Her height was 5 feet 4 inches (163 cm) and her weight 124 pounds (56 kg). She complained of pain in the right foot of 3 to 4 days' duration. She recalled that she had experienced pain while she was very active looking after children and had taken a forceful step for ward beyond this there was no history of trauma to the foot.

Examination disclosed tenderness and swelling of the fore part of the right foot with increased local tenderness and pain of the outer side. The patient formerly had worn rubber arch supports but for the past 2 months she had worn steel supports. Roentgenograms gave evidence of a fracture of the proximal end of the fourth metatarsal bone. Additional findings were bilateral hallux valgus with marked callus of both feet.

CASE 9 A merchant aged 38 years reported for examination December 5, 1933. His height was 5 feet 10½ inches (179 cm) and his weight 180 pounds (81 kg). He complained that 1 week previously without preceding illness or injury he had been seized with pain and swelling in the fore part of the left foot. He said that he had been on his feet a great deal preparing his shop for Christmas.

Roentgenograms gave evidence of a fracture of the distal third of the second metatarsal bone of the left foot.



Fig 6 a and b Lateral views of same foot as that represented in Figure 5 a and b

let, is present, and closure of this valve is produced automatically by the weight of the upper bottle. As will be seen from the diagram, the air outlet tube (I have used the thin tubing of the blood-counting pipettes) is led away from the rubber stopper between the neck of the bottle and the ring on which it rests. The frame allows the bottles approximately one-quarter inch movement in a vertical direction, and the lower bottle drops away from the tubing at the same time that the upper bottle drops onto it.

Our own apparatus was built of materials found in any hospital, and the carpenter estimates the

cost as less than two dollars. Since only simple reversal of the inside frame is needed to keep the suction, the physician is spared the necessity for straightening out a complicated arrangement of tubes and bottles which is seldom understood by hospital attendants.

Construction details and the arrangement of the tubing and bottles probably call for no further explanation than the diagram. The irrigation (shown in dotted lines) and drainage bottles are those used for commercial intravenous solutions. The entire frame is mounted on casters and can easily be moved to any part of the hospital.



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A NEW TYPE OF SUCTION APPARATUS

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MOST physicians with hospital practices have felt the need for a suction apparatus which is inexpensive, simple, dependable, and foolproof. The machine illustrated has answered this need so well at the Sonoma County (California) Hospital that it seemed worth while reporting. Over a period of some months it has given thoroughly satisfactory service on patients requiring stomach,

bladder, gall bladder, or chest drainage without a single mechanical difficulty.

The negative pressure is obtained through the upside down siphon arrangement in common use, the only departure from the usual procedure being the use of two ordinary gallon bottles which empty into each other reversal of the flow is produced by rotating the inside frame in which the bottles rest. Only one valve for the air out

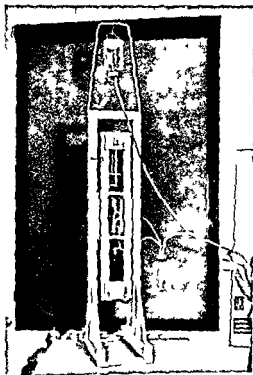


Fig 1 Photograph of apparatus

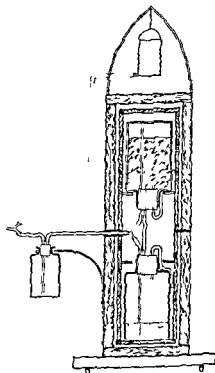


Fig 2 Diagram showing construction of apparatus

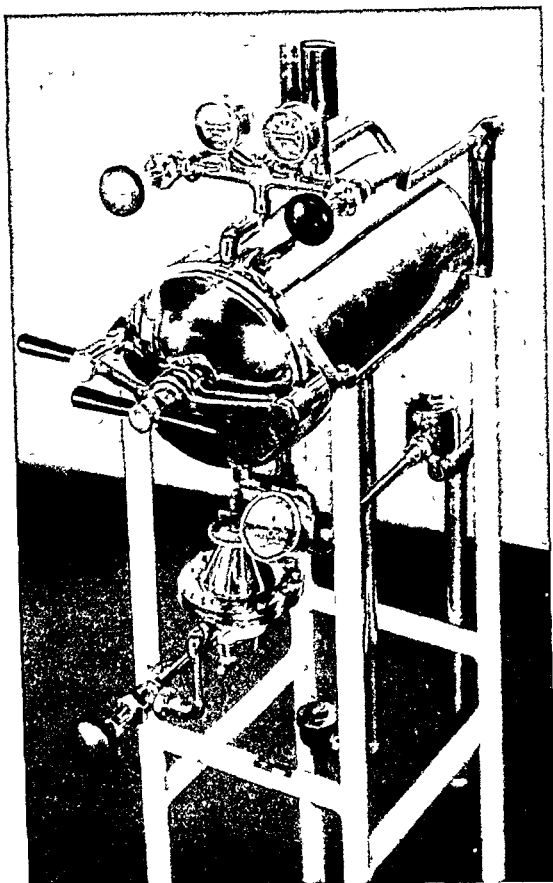


Fig 1 The specially constructed, high speed autoclave permits the rapid sterilization of instruments in 4 minutes

Spores of the most heat-resistant organisms can be destroyed at 273 degrees F in 2 minutes (2, 3) An automatic, recycling timer meters a consecutive sterilizing interval of 3 minutes and signals that the load is sterile and that the steam may be vented. Pressure in the chamber can be relieved almost instantaneously. A detachable handle is then fitted to the sterilizing tray and the instruments can be carried to the operative field without danger of dropping or contamination (Fig 2). This technique enables the circulating nurse to return an instrument to the operating table with no compromise of aseptic technique less than 5 minutes after it was dropped to the floor (Fig 3). Because of the rapid action and high temperature attained in this sterilizer, spotting and corrosion of instruments are eliminated. Hence preheating and drying periods are unnecessary.

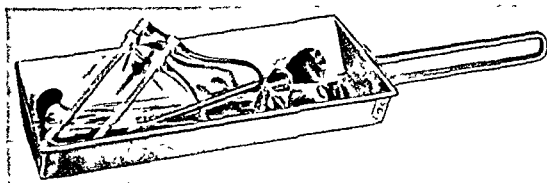


Fig 2 Sterilizing tray with detachable handle provides for safe transport to the operative field

The second problem in protecting asepsis, the disinfection of instruments from septic cases or instruments soiled by pus or feces where spore bearers are likely to be encountered, has received much attention. The danger of spore-bearing organisms in the operating room has been recognized and special techniques for the routine sterilization of such instruments have been devised. The number of techniques in use and the wide range of minimum standards for sterilization of these instruments are indications of the inefficiency of the existing methods of caring for "dirty" instruments. The only safe bacteriologic technique of those in current use is that of

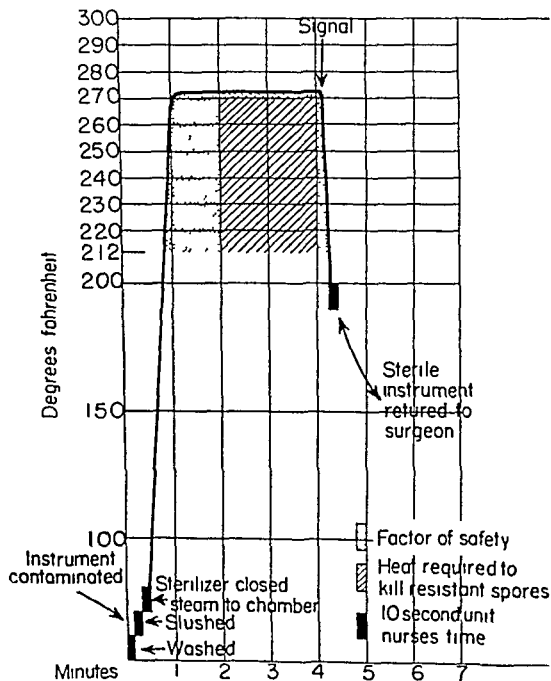


Fig 3 A safe technique for the sterilization of instruments urgently needed by the surgeon provides for rapid, absolute sterilization. The chart illustrates the time and temperature relationships throughout the sterilizing cycle.

TECHNIQUE FOR THE RAPID AND ABSOLUTE STERILIZATION OF INSTRUMENTS

CARL W. WALTER, M.D., Boston, Massachusetts

ASEPTIC technique depends for its success upon the reduction to a minimum of the bacteria introduced into the tissues. Every operative wound is inevitably contaminated by air borne bacteria (4, 9, 13, 20) and the bacteria present in the skin of the patient (1, 13, 19). The sterilization of the operative site and the hands of the surgical team is necessarily a relative matter, and is an attempt to reduce contamination to a minimum. The sterilization of instruments, dry goods, suture material, rubber goods, and solutions used during an operation is, however, under the control of the surgeon and can be made sufficiently thorough to destroy all bacterial life. Nevertheless the common practice in sterilizing instruments, gloves and sutures for the operating table does not insure absolute sterility (5, 6). Bacteriologists have repeatedly pointed out that boiling water does not kill spores even after prolonged exposure (5, 11, 16, 18). Abbreviated boiling periods (14) the use of oil on instruments (5, 16) the formation of scale in hard water areas (8), and depressed boiling temperature caused by altitude are additional factors causing inadequate sterilization. The safety of a technique based upon boiling depends upon the care with which spore bearing organisms and spores have been excluded by mechanical means. Inevitable disaster results whenever dangerous spores are not removed from instruments prior to sterilization by boiling.

Even in operating rooms where supplies and the original instrument kits are adequately sterilized prior to operation there are opportunities for unsterile instruments or dangerous spores to reach the operative field. These breaks in aseptic technique are sanctioned by surgeons because there have been no reliable methods for either the emergency sterilization of instruments or the post-operative sterilization of instruments contaminated with oil, feces, blood or pus known to contain virulent bacteria or spores. Two new types of sterilizers designed for these specific purposes have been in use at the Peter Bent Brigham Hospital for 2 years. They have proved to be such

practical additions to the sterilizing facilities that they have supplanted boiling sterilizers in the operating room.

The problem of emergency sterilization arises daily. Every surgeon is familiar with the embarrassing delay caused by the omission of instruments from the kit, or has been inconvenienced by inadvertently dropping a special instrument or has been forced to wait for instruments required by a change in the operative procedure caused by unexpected pathology. In many clinics 'quick sterilization', boiling for one or two minutes in a small electric sterilizer, or chemical disinfection 'just wipe the instrument with a germicide' are sanctioned because of the emergency. In operating rooms where more thorough emergency methods are used the impatient surgeon may stampede a timid circulating nurse into returning an instrument to the operative field before it has been adequately sterilized.

Safe emergency sterilization can be carried out quickly and efficiently in a specially designed and constructed steam jacketed autoclave of the conventional horizontal type (Fig. 1). The accessory equipment, steam pressure regulator, operating valves, air ejector and piping have sufficient steam capacity to complete the sterilizing cycle in a chamber 9 inches in diameter and 19 inches long in less than 4 minutes. Operation is simple, easy, and sufficiently quiet so that the sterilizer can be used in the operating room without causing annoyance.

Steam is admitted to the jacket of the emergency sterilizer prior to an operation and a steam pressure of 27 pounds (gauge pressure) is maintained until the operative procedure is finished. Thus the sterilizer is instantly available and condensation in the chamber is eliminated. Before placing instruments in the sterilizer gross dirt and grease must be removed by scrubbing with soap and water and flushing in a fat solvent. The clean fat free instruments are placed in the sterilizer on a perforated metal tray and the door is closed tightly. Steam is then admitted to the chamber so rapidly that a sterilizing temperature of 212 degrees F. is attained in 40 seconds.

From the Surgical Clinic of the Peter Bent Brigham Hospital and The Laboratory of Surgical Research Harvard Medical School

Fig. 1. Emergency sterilizer. A. Steam pressure regulator. B. Air ejector. C. Piping. D. Chamber. E. Perforated metal tray. F. Door. G. Control valve.

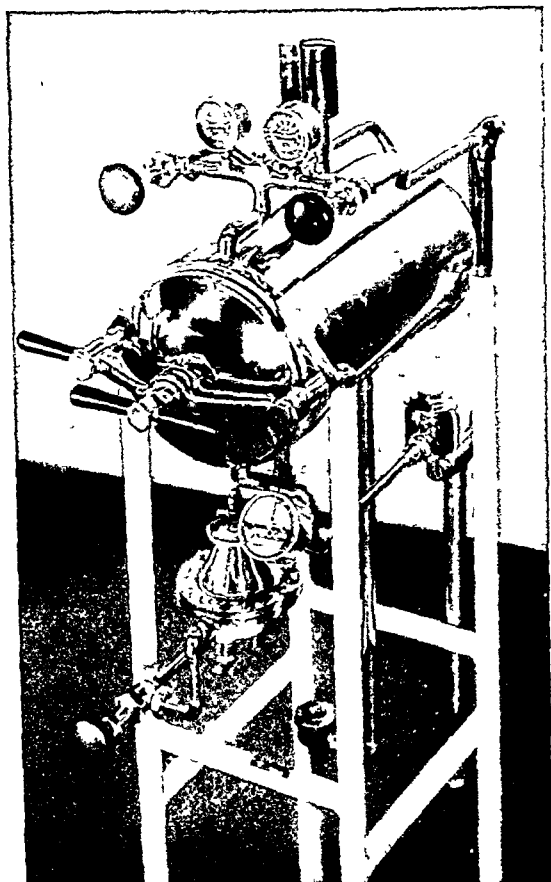


Fig 1 The specially constructed, high speed autoclave permits the rapid sterilization of instruments in 4 minutes

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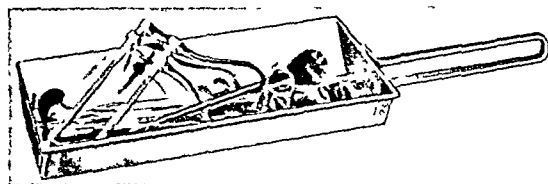


Fig 2 Sterilizing tray with detachable handle provides for safe transport to the operative field

The second problem in protecting asepsis, the disinfection of instruments from septic cases or instruments soiled by pus or feces where spore bearers are likely to be encountered, has received much attention. The danger of spore-bearing organisms in the operating room has been recognized and special techniques for the routine sterilization of such instruments have been devised. The number of techniques in use and the wide range of minimum standards for sterilization of these instruments are indications of the inefficiency of the existing methods of caring for "dirty" instruments. The only safe bacteriologic technique of those in current use is that of

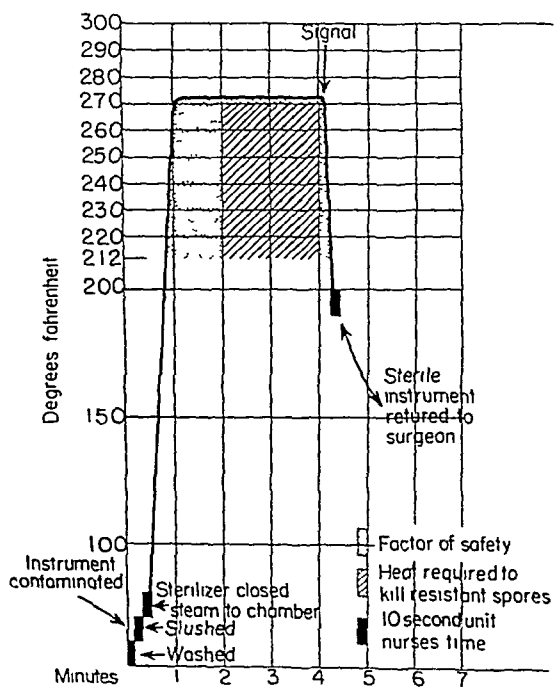


Fig 3 A safe technique for the sterilization of instruments urgently needed by the surgeon provides for rapid, absolute sterilization. The chart illustrates the time and temperature relationships throughout the sterilizing cycle.

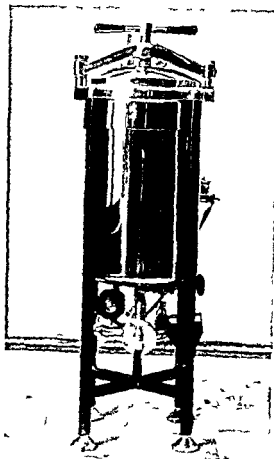


Fig 4 The instrument washer and sterilizer frees instruments of blood feces pus or grease while they are being sterilized

immersing the soiled instruments in a 10 per cent soap solution and autoclaving them at 250 degrees F for 30 minutes. This practice has the disadvantage of using equipment primarily designed for another purpose. The interior of the autoclave is usually fouled with soap and denatured proteins which are spattered on the chamber wall when the steam is vented. The danger of scalding the attendants who remove the instruments from the sterilizer is great. Soaking dirty instruments in a germicide prolonged boiling after thorough scouring and scrubbing or combining these in various ways is not only time consuming but also removes the instruments from circulation. What is of greater importance to safety dangerous spores may be spread throughout the operating room during the cleansing process or sterilizers

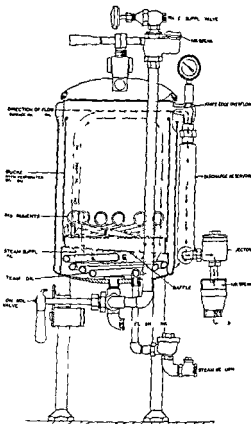


Fig 5 Diagram of the sterilizer utilizing superheated water as the cleansing and sterilizing agent

may be contaminated with spores which survive hours of boiling.

A safe rapid technique for the cleansing and sterilization of such instruments is that of exposing them to superheated water in a sterilizer designed to remove the oil and scum from the surface of the water leaving at the most a monomolecular (12) film of oil which can be sterilized (16). This is done conveniently in a vertical autoclave constructed to withstand an operating pressure of 2 pounds per square inch (gauge pressure) (Fig 4). The dirty instruments are collected in a stainless steel bucket directly from the instrument table. The bucket is placed in the sterilizer over a baffle which forces water to circulate through perforations in the bottom of the bucket (Fig 5). A steam coil located beneath the baffle supplies adequate heat for rapid sterilization and sets up convection currents in the water to carry the oil and grease which leave

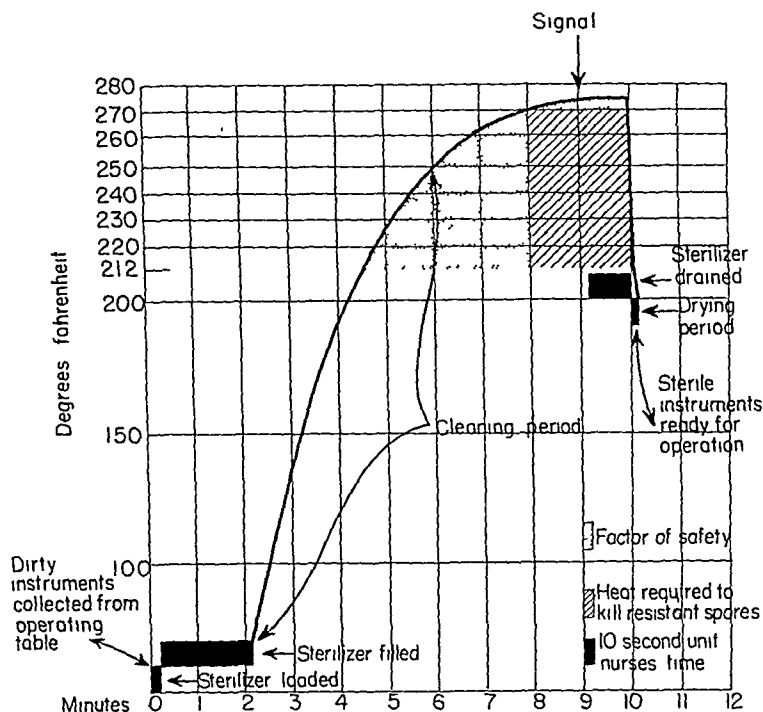


Fig 6 Instruments can be cleaned, sterilized, and dried in 7 minutes. Time and temperature relationships of the superheated water sterilizer are charted.

the instruments and rise to the surface, toward an overflow at the rear of the sterilizer. The continual rise in the water level, due to the expansion of the heating water, carries the oils and scum formed by the blood and pus over a knife edge overflow into a reservoir whence it is discharged into the drain by a special ejector. The addition of a detergent, to peptonize the proteins and saponify and peptize the greases, removes all the dirt, eliminating the necessity for mechanical cleansing of the instruments. The use of sodium metaphosphate in the detergent (15) softens the water¹ and prevents the precipitation of a film of alkaline earth soaps and salts on the instruments (8). The temperature of the water is raised to 273 degrees F in 7 minutes, a signal light indicating when the steam supply is to be shut off (Fig 5). The superheated water is rapidly drained into a flash tank, exposing the instruments to saturated steam for approximately 1

minute while the pressure is being relieved. The residual heat in the instruments is sufficient to flash any adherent moisture and the clean, dry, sterile instruments are ready for immediate use upon removal from the sterilizer. The action of this sterilizer is so rapid and satisfactory that it

TABLE I — CONCENTRATIONS

*Total hardness of water as CaCO ₃		Ounces of calgonite to be added to sterilizer
G P G	P P M	
5	85	2
10	171	4.5
15	256	7
20	342	9
25	427	11.5
30	513	13.5
35	598	16
40	684	18
45	769	20.5
50	854	23

¹The detergent, Calgonite (7), (Calgon Inc., Pittsburgh, Pa.) contains:
Sodium hexametaphosphate 40
Trisodium phosphate monohydrate 15
Sodium metasilicate pentahydrate 40
Sodium hydroxide 5

When used in the concentrations shown in Table I, it will not damage surgical instruments (17) and will sequester the calcium ion and prevent the formation of films of insoluble adherent alkaline earth soaps and salts.

G P G — grains per gallon

P P M — parts per million

*Information may be obtained from local boards of health

may be used for the routine sterilization of instruments thereby supplanting less efficient methods.

These new sterilizers provide a safe rapid method for emergency sterilization and a safe technique for cleansing and sterilizing instruments contaminated with spore bearing material. Potential breaks in aseptic technique sanctioned heretofore because safer methods were not available are eliminated, permitting the practical establishment of a higher standard of asepsis.

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FRACTURES OF THE LOWER END OF THE RADIUS

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FRACTURES of the lower end of the radius constitute about 11 per cent of all fractures cared for at the Massachusetts General Hospital. During the period from 1918 to 1935 there were 870 cases of this fracture. Most of these patients were treated in the Emergency Ward and in the Out-Patient Department, so that detailed records of the treatment given and of the results obtained are not available. End-result studies were made primarily on the patients who were admitted to the hospital for care, either on account of other complicating injuries or because of unusual problems presented by the fracture itself. Thus, the cases studied are not truly representative of the entire series, and it is fair to assume that the results in the uncomplicated cases which were not followed up are superior to those in the cases studied.

The age and sex distribution of our patients was not remarkable. While the sexes were about equally involved, the fractures in males occurred primarily during adolescence, during the period of active physical life, while among females the middle-aged group showed the greatest frequency.

DIAGNOSIS

Because of the frequency with which the injury is seen and the characteristic appearance of the wrist, the diagnosis of Colles' fracture is generally made from clinical examination alone. This is not always true, however, for in a surprisingly large number of the patients in our group the correct diagnosis had not been made by the first physician who treated the injury.

In general the patient comes in carrying the hand in a sling position and giving the typical history of a fall on the outstretched hand with immediate pain and disability. Upon examination there are noted swelling of the wrist and marked tenderness, localized over the fracture. Obvious alteration has occurred in the surface landmarks producing a characteristic silver fork deformity. The hand appears to be displaced backward and abducted in relation to the forearm. Abnormal mobility or crepitus may be present but are unusual. An x-ray examination should be made whenever there is the slightest suspicion of injury and should

be relied upon to disclose the full details of bony damage and displacement.

The exposures should be made in both antero-posterior and lateral planes. One should bear in mind the possibility of an associated injury to one of the carpal bones and roentgenograms should be carefully scrutinized to clarify this point. The clue to the amount of displacement is to be found particularly in the films made in the lateral plane. Normally the plane of the distal surface of the radius is directed slightly forward so that it forms an angle of 85 to 80 degrees with the longitudinal axis of the shaft. Displacement is manifested by alteration in this relationship, the articulation facing backward to greater or lesser degree. Restoration of the normal angle of the articulation is important from the standpoint of recovering the ability completely to flex the wrist. When there is doubt as to the amount of displacement, films should be made of the normal wrist for purposes of comparison. In addition, to the amount of displacement, degree of comminution, and impaction which can be observed in the x-ray films, attention is called to the position of the ulnar head as seen in the lateral view. Any tendency for the ulna to assume an anterior position suggests the disruption of the radio-ulnar joint through loss of the integrity of the triangular ligament.

MECHANISM

Through a fall on the outstretched hand the commonest fracture is a simple transverse fracture 1.25 to 2 centimeters above the joint margin. Displacement may be absent or present in varying degrees. Usually the distal fragment, carrying with it the hand, is displaced backward and upward with reference to the proximal fragment causing a foreshortening of the hand upon the forearm and resulting in the typical silver fork deformity. At the same time, the distal fragment tilts backward so that the articular surface of the radius looks backward instead of slightly forward as is normal. The distal fragment is also slightly rotated in the direction of supination with relation to the proximal fragment. Some degree of impaction is commonly present, the dorsal edge of the proximal fragment being driven into the distal fragment. Despite the displacement, comminution, and impaction, the problem is simply that of

From the Surgical Service of the Massachusetts General Hospital

a fracture in the shaft of a long bone when the triangular ligament is not ruptured. The intact radio-ulnar joint serves as a fixed point around which to reconstruct the normal anatomy.

As the force continues backward and upward, displacement of the lower end of the radius becomes extreme and a disruption of the inferior radio-ulnar joint occurs. If displacement is marked, strain is exerted through the mediocarpal ligament and the discus interarticularis upon the ulnar styloid and this is frequently fractured. In other cases the ulnar attachment of the ligament gives way or the cartilage may be torn across. When general fragmentation of the lower end of the radius into the joint occurs, a similar disintegration of the joint takes place.

It is our contention that the successful management of Colles' fracture revolves around the integrity of the radio-ulnar joint which in turn depends upon an intact triangular ligament. If this is true we may arbitrarily divide our group of Colles' fractures into two main groups.

1. Fractures with triangular ligament intact

2. Fractures with loss of integrity of the radio-ulnar joint which may occur in one of three ways: (a) rupture of the ligament itself (b) avulsion of the ulnar styloid at its base (c) severe comminution of the lower end of the radius with the ligament remaining attached to a minor medial fragment.

FIRST GROUP

In the first group in order of severity are (1) fractures of radial styloid (2) simple epiphyseal separations (3) simple transverse fractures.

The problem of anesthesia, reduction and fixation is essentially the same for the entire group.

Anesthesia. In general the members of the staff feel that complete anesthesia is necessary for manipulation. *Reduction* of these fractures. Either has been the choice unless contraindicated. Novocain, however, may readily be used in this group. After thorough preparation of the skin with iodine 15 to 20 cubic centimeters of a 2 per cent solution of novocain is injected on the dorsum preferably directly into the line of fracture. A definite interval should elapse before beginning the reduction. Recently a large group of fractures in this first group have been reduced in the emergency ward under intravenous evipal anesthesia with satisfactory results. Inasmuch as respiratory depression occasionally follows the use of evipal we have not employed it when there has been any question of skull injury.

Reduction. This group may satisfactorily be reduced without the aid of the fluoroscope. In general when the triangular ligament is intact the

problem of reduction follows the general principles of (1) breaking up the impaction by traction—adduction and abduction, (2) acute flexion with dorsal pressure on the distal fragment. Rarely is overcorrection obtained and once an adequate reduction is effected there is little tendency to recurrence. Adequate reduction requires that the impaction be broken up. Consequently, following reduction, the wrist should hang easily in flexion, crepitus must be obtained, and the normal landmarks re-established.

Fixation and after-care. Following the reduction simple anterior and posterior splints of molded plaster are sufficient. The patient is encouraged to move the fingers from the outset. The patient is observed at intervals during the first day to confirm the absence of circulatory disturbance in the hand. Pain calls for immediate revision of the apparatus. The splints are removed alternately to permit stroking and light massage after 2 days. Guarded active motions are begun after a week or 10 days. One splint is discarded after about 2 weeks and all splints are removed after about 3 weeks. Following removal of the splints a simple wrist strap is advised for protection against extremes of motion. The patient is instructed in exercises to increase the extremes of active motion. Children may require a longer period of splinting than adults.

SECOND GROUP

When the integrity of the inferior radio-ulnar joint is lost through (a) rupture of the triangular ligament (b) avulsion of the base of the ulnar styloid or (c) severe comminution of the radial articular surface, a much more complicated problem in treatment is presented. In the first group the problem is simply that of adequate reduction. In the more complicated cases of the second group there is now added the problem of maintenance of the reduction by proper fixation. It is by no means easy to obtain an adequate reduction in these cases for there is no fixed point around which to build either the reduction or the fixation. Obviously the ordinary means of fixation used in simple transverse fractures will not suffice. When disintegration of the joint has taken place slipping of the fragments is all too common.

Anesthesia. In dealing with any joint fracture it is of utmost importance to restore the normal anatomical relationship as completely as possible. Consequently the reduction should be done under the fluoroscope, a general anesthetic being used, preferably ether. Unless there is a definite contraindication to ether little brief is held for novocain anesthesia for these more complicated cases. Full

relaxation is essential and cannot be obtained uniformly with novocain injection. Attempts to do so have resulted in incomplete reductions requiring further reduction under a general anesthesia.

Reduction The commonest defect of reduction was the failure to break up the impaction completely, with a consequent shortening of the radius and a backward tilt of the articular surface. This was most common in the group in which disintegration of the radio-ulnar joint had been unrecognized. Complete reduction requires that the radius must be restored to its full length with a proper forward tilt of the articular surface. At the same time the ulna must be restored to its dorsal position and brought into close apposition to the radius to prevent widening of the wrist.

Fixation The most stable position will be found to be one of palmar flexion with extreme pronation and ulnar deviation, the so called Cotton-Loder position. If the ulna has been restored to its dorsal position, this maneuver wedges the cuneiform bone partly beneath the distal ulna, and prevents its forward luxation. This then gives stability to the ulnar side of the wrist, and continuance of the position to the extreme puts traction on the dorsal and lateral ligaments attaching to the fragments of the distal radius, thus helping to restore them to position by using the wedged ulna as a fulcrum. Continuance of ulnar deviation serves further to snug the radius up to the ulna and to permit reparative processes to reconstruct the ligamentary attachment. Maintenance of the position and complete immobilization is greatly facilitated by immobilization of the elbow which prevents any possibility of supination. Acute palmar flexion without pronation or ulnar deviation will not suffice to maintain the reduction. Maintenance of reduction and immobilization are accomplished by a plaster cylinder or preferably by the use of the so called sugar-tong splint made of a single strip of plaster.

AFTER-CARE

Some of the poor results are traceable to loss of reduction after it is secured. This may be due, in addition to the type of injury, to improperly fitting splints, to excessive padding, to failure to prevent elbow motion of pronation and supination, or to wilful tampering with the splints by irrational or unco-operative patients.

While it is probable that in some instances splints have been removed too early and that pain in an unsupported fracture has prevented or delayed proper return to function, we have been impressed by the extreme delay and disability in some arms splinted too long. The extreme Cotton-Loder position should not be maintained for

longer than 10 days, for should fixation occur in this position it is the most useless of all functional positions. After 10 days the wrist is restored to the neutral position in anterior and posterior splints. The general program of removing the splints one at a time to permit massage is then followed. Disability usually lasts for 2 months. Any disability beyond that time is due either to improper reduction or maintenance of reduction, or to too prolonged splinting, or to failure of the patient to co-operate.

The poor results obtained in the treatment of Colles' fracture are in part due to the failure to recognize the fundamental difference in the problem in the two groups. Not only must each fracture be treated as an individual problem, but we must recognize that in the last group with disintegration of the joint or comminution into the joint possible failure results from the very nature of the injury.

FLEXION FRACTURES

Only 2 cases in the end-result series could be classed as flexion fractures. In these cases the distal radial fragment is displaced anteriorly. The fracture line may be either oblique or transverse. As has been pointed out by W. S. Wood, the transverse fractures may be reduced by closed reduction, provided the mechanism is recognized and the appropriate maneuvers are employed in reduction and fixation. Obviously, the reduction calls for hyperextension rather than flexion, and the splinting is in a cock-up position. It is doubtful whether the oblique fractures with anterior displacement can be satisfactorily maintained by any method of closed reduction and fixation. While it is probably worth while to attempt closed reduction, post reduction x-ray films should be studied and resort to operative interference should be prompt if closed methods prove inadequate. In our cases the condition probably was unrecognized and the fracture not properly reduced, and as a result the patients were left with deformity and residual disability. In a recent case of oblique flexion fracture the patient was treated by open reduction and internal fixation.

COMPOUND FRACTURES

Our series includes 4 cases of compound fracture. Their management involves the general principles applicable to compound fractures. Sepsis is extremely disastrous because the multiple joints and tendons may become involved. Immobilization in extreme position is avoided if possible. It may be necessary to neglect the fracture entirely and limit active treatment to the wound.

EPIPHYSEAL SEPARATION

Our series of end result cases includes 22 instances of separation of the lower radial epiphysis. In nearly half of these cases there was a delay of a week or more before treatment was sought. Many of these patients, especially in the earlier years, were subjected to repeated manipulations and even to osteotomy to restore the epiphysis to its proper position. Since Aitken's excellent presentation of the satisfactory results of conservative measures, we have been less zealous in our attempts to secure anatomical reposition. Certainly osteotomy or attempt at operative restoration increases the likelihood of growth disturbance. For late deformity, due to cessation or distortion of growth, we have carried out the operation advocated by Darrach, Cotton, and others, with great satisfaction.

DELAY

Delay in reduction appeared as a significant cause of poor results in many of our cases. When the patients first present themselves a week or more after injury, the question is raised whether reduction should be attempted. The severity of the displacement and the age and social status of the patient must be evaluated. In general we have been unwilling to attempt closed reduction if more than 2 weeks have elapsed since injury. In such cases progress seems to be better if a regimen of early active motion is instituted at once. Many such patients were subjected to early osteotomy or other operative reductions but the results of these operations have not been particularly brilliant. This is in contrast to operations undertaken 6 months or a year after injury after a period of active use for the correction of a specific disability.

OPERATIVE TREATMENT

A few early fractures may require open reduction if closed reduction cannot be secured and maintained. However it seems to us better in most cases to resort to early active motion and to defer operation until time has established the nature and extent of the disability or deformity. Marked backward angulation may be corrected by osteotomy. Excessive shortening may require resection of the ulnar head to restore proper carpal relations. Subluxation of the ulna, or permanent loss of the attachments of ulna and radius causes limitation and pain on pronation and supination. This condition can be greatly improved by resection of the distal end of the ulna. Attempts to repair or reconstruct the triangular ligament are less simple and less satisfactory.

SUMMARY OF END-RESULTS

End result studies were made in 101 cases of fracture of the lower end of the radius including 22 epiphyseal separations. It should be emphasized again that these are the complicated and more severe fractures from a total series of 8,000 cases. In 74 cases treatment was by closed reduction, and in 27 by operation, including the 4 compound fractures. Patients were observed at least a year after injury, those with epiphyseal injuries were usually followed many years.

In the group treated by closed reduction, 10 showed a poor anatomical result, as revealed by x ray and clinical examination. Only 4 showed marked functional impairment and only 3 were seriously handicapped economically. It is noteworthy that functional results were often excellent even when late x ray studies showed some persistent deformity. It is also noteworthy that all patients with excellent anatomical restoration presented also an excellent functional result.

In the group of 27 operative reductions and compound fractures, 10 showed poor anatomical reduction, 4 showed marked functional impairment and 2 were seriously handicapped economically. Thus in the entire group it may be said that 80 per cent presented a satisfactory anatomical end result, 90 per cent presented good function and only 5 per cent presented a serious economical handicap.

Detailed analysis of the poor results emphasizes the significance of the severity of the injury, delay before treatment, adequacy and maintenance of reduction, oversplinting, proper time and selection of operation and the attitude of the patient. Flexion fractures and compound fractures rather obviously are more serious, and likely to give poor end results. We wish to emphasize that fractures involving disintegration of the inferior radio-ulnar joint also constitute a more serious group, and that failure to recognize the complicating injury, or to effect and maintain adequate reduction is responsible for many of the poor end results following the treatment of Colles' fracture.

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EDITORIALS

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ENDOMETRIOSIS—A POSSIBLE ETIOLOGICAL FACTOR

ENDOMETRIOSIS is the name given to ectopic endometrium wherever found in the pelvis, and endometrioma to the individual lesion. It never occurs above the pelvic brim but does in the umbilicus, the inguinal canal, the vulva, and occasionally in the vagina. The term adenomyoma is frequently used for the same lesion but preferably it should be confined to areas in the uterus which are just under the endometrial lining.

During the past year and a half the incidence of endometriosis in my private practice has been 16.7 per cent of all gynecological cases operated upon and 32.2 per cent of all abdominal gynecological cases. This editorial is an attempt to account for an apparent increase of this interesting pathological entity. A theory that may clarify the great incidence of this lesion is as follows: the more well to do patients seen in private practice have many years of menstruation before an interruption

by pregnancy. This is due to late marriage, contraception, and spacing of children, which in turn are due to modern economic factors. The pathologist to the hospital, Dr. Tracy B. Mallory, has frequently remarked that the number of cases brought to his laboratory from private practice is much greater than the number from the general hospital practice. There are probably two reasons for this (1), that certain surgeons interested in endometriosis send their pathological specimens to the pathologist well marked and that some surgeons find more specimens to send because of their diligent search for the disease; and (2), because the patients in the general hospital are of the type that marry early, have large families, and do not practice birth control. One other factor noticed in patients with endometriosis is the great number of patients with stigma of underdevelopment; for example, congenital erosion of the cervix, fibroids, dysmenorrhea, sterility, etc.

It is doubtful if the young female monkey, a menstruating animal in its natural habitat, has many periods before mating takes place and pregnancy begins. Following the birth of the young monkey the mother nurses her offspring, and at the end of the nursing period it is likely that another pregnancy begins. During the time of nursing it is probable that periods are not the rule, just as in the human. In other words, the number of menstrual periods of the female monkey is certainly smaller proportionately than in modern woman. During pregnancy and nursing the secretion of the hormones, estrin and progesterin, is not the same as during normal menstruation. Therefore the customary rhythmic change in the endometrium and endometrium-like tissue is not present.

In older times when our feminine ancestors were interested in very little but the home and family, early marriages and large families were the rule and nearly all mothers nursed their offspring. Thus these women of former times more nearly approached the natural state of the only other species that has menstruation or rhythmic bleeding.

Without doubt endometriosis existed before John Sampson of Albany called our attention to it in 1921, but our older surgeons and gynecologists saw less of it before that time because the days of late marriages and spaced pregnancies had not arrived. *It does not seem possible that men as able as our predecessors would not recognize and be concerned with such an entity if it were present in one third of all their pelvic operations. It is reasonable to assume then that the reason they did not recognize endometriosis is because it was not so common as it is now.*

Two types of patients have endometriosis, those who are normal in every way except that marriage and especially pregnancy are delayed and those who have stigma of pelvic underdevelopment. *The latter often do not marry, and if they do, frequently do not conceive.* Sampson's theory of a reflux of endometrium through the tubes is plausible but not so satisfactory as that of Iwanoff and Meyer who predicate a development of cells of the celomic epithelium, the predecessor of muellerian epithelium. If in certain patients genital underdevelopment is present the prolonged stimulation of the underdeveloped tissues by a long uninterrupted menstrual career causes cells in the celomic epithelium to grow and to reproduce organs that they are concerned in developing. Inasmuch as the celomic epithelium is the precursor of the muellerian ducts which in turn precede the tubes, uterus, cervix and the ovarian peritoneal covering it is not reasonable to assume that under

prolonged stimulation left over cells of this tissue might commence to grow? Endometriosis is so widespread and is found in so many different parts of the pelvis that it is not reasonable to believe that it all comes through the tubes or metastasizes from the uterus. It cannot be denied that Sampson's theory explains certain cases well but it does not explain all cases of endometriosis as well as the theory of stimulation of the celomic epithelium. Witherspoon's idea of estrin stimulation being the causative agent is probably correct, but normal estrin stimulation would not produce the lesion. It is necessary to have a protracted stimulation without interruption in normal women or a normal or excessive stimulation upon an underdeveloped pelvic epithelium.

The theory advanced then is that women with a stigma of underdevelopment (and many of these do not marry because they are also underdeveloped sexually) and well developed women who put off marriage too long or who try to put off pregnancy until well after married life has begun are likely to develop endometriosis. It is therefore better that there be earlier marriages and that contraception be put off until at least one or two pregnancies have occurred. What is more pathetic than the girl who marries and for economic reasons can't have a baby, who later goes to her doctor with a sterility problem that cannot be solved?

Unquestionably it will be difficult to prove our concept, but an analysis of the cases of endometriosis seen in the last 100 abdominal operations gives suggestive support. In the résumé it is obvious that there are a few outstanding findings in support of the theory as follows: (1) The percentage of cases with stigma of underdevelopment of some part of the genital tract is large—75 per cent. (2) The percentage of patients without children

is great—43.7 per cent (3) The use of methods of contraception is great—66.6 per cent (4) The age of marriage is late, an average of 26.2 years (5) The menstrual years per patient are many, all but one of the series having menstruated for 16 or more years before developing the lesion and all but 3 menstruating 10 years or more before the birth of the first child Dr Thomas R Goethals, having reviewed the records of his private patients for the past year, finds that most primiparae fall into two age groups—25 years and under and 26 years and over, 30 per cent are in the younger group and 70 per cent become pregnant the first time at or after the age of 26 It is obvious from his observation that there is a class of patients who are putting off pregnancy or at least who have not had the opportunity to become pregnant until the latter half of the third decade It is this group that is courting endometriosis

The argument then is as follows menstruation, through the hormones estrin and progesterin, causes a growth and functional change in the endometrium This change, a preparation for pregnancy, should in a normal female be utilized. Monkeys surely have no such menstrual career as modern women, for mating and interruption of menstruation by pregnancy occurs early and frequently In the modern woman, late marriage, contraception, and the like, allow a prolonged menstrual life without interruption It is generally conceded that the peritoneal covering of the ovaries and uterus and the pelvic peritoneum are derived from the celomic epithelium. The muellerian ducts arise from the celomic epithelium and form the tubes, uterus, and cervix In the course of such formation cells of muellerian epithelium and areas of primitive celomic epithelium may not be utilized Under too prolonged and uninterrupted stimulation of the hormones, estrin and progesterin, un-

utilized cells of the celom may become muellerian or uterine and thus produce endometriosis, while under even shorter stimulation the epithelium of the patient with stigma of underdevelopment may develop into endometriosis.

JOE VINCENT MEIGS

PLASTIC SURGERY IN GREAT BRITAIN

A SURVEY of plastic surgery in Great Britain is not without interest to those in the United States who either practice or intend to practice this somewhat vaguely delineated specialty. For many years plastic surgery has been what each individual surgeon made of it—a loose field, unsatisfactory in name, whose boundaries automatically established themselves by reason of the surgeon's own training, inclination, or opportunities Thus we have dental surgeons and maxillofacial surgeons dealing with injuries, diseases, and malformations of the jaw, while others extend this field to include the treatment of almost any facial condition. A great many otorhinologists, laryngologists, and ophthalmologists undertake the plastic treatment of the nose, eyelids, and ears as part of their routine work Then again there are general surgeons who are particularly interested in the treatment of cleft lip and palate, and the deformities of childhood Others who call themselves cosmetic or esthetic surgeons are confined to the treatment of cosmetic disabilities and differ widely in intention, character, and ethical standards Finally there are what might be termed constructive surgeons who concern themselves only with the repair of superficial body defects as opposed to the cure of the ravages of disease, and who carry their principles into effect from the scalp to the soles of the feet The last named today represent the dominant type of plastic surgeon in Great

Britain The purely constructive idea to a certain extent has spread to the continent, and is expressed in the suggestion that the specialty should in future be called "structive surgery" In our inelastic language there is no word which exactly translates this idea, "constructive" or "reparative" being admittedly inadequate substitutes By common consent the term 'plastic' with all its unwelcome associations would appear to be firmly established both in the lay and professional mind, and it is probable nothing else will supplant it

The Great War undoubtedly gave plastic surgery its most substantial fillip, but it somewhat arbitrarily limited the field to maxillo-facial repair In many parts of the world it exists in this form today, and is regarded as an offshoot of otorhinolaryngology, or dental surgery In Great Britain and in certain parts of the U S A , however, the past twenty years have seen a remarkable extension of the plastic field and a changing conception of its relationship to the other surgical specialties, and to surgery in general This probably reflects the broader outlook of those surgeons who have been attracted to plastic work from general surgery rather than from other branches of medicine Thus we find that the field includes the reconstructive and reparative surgery of a wide variety of congenital and acquired superficial defects, the cure of which necessitates a study of the principles of pure repair Such a constructive ideal has much in common with the fundamentals of orthopedic surgery, and is in sharp contrast to the Hunterian opinion that operations in general are a tacit acknowledgment of the insufficiency of the healing art, in that they of necessity destroy in order to heal It is an interesting commentary on modern trends of surgical thought that today an increasing number of surgeons are seriously concerned not with the cure of disease or the relief of physical pain but with

the repair of defects the majority of which will not shorten the patient's life by one minute nor give him a moment of physical pain Their aim is to restore defects of physical appearance to that functional normality which will enable the sufferers to pass among their fellowmen without comment, to earn their living, to marry, and to become economic members of the community The concept that surgery can be usefully employed for the relief of mental suffering is not new but it has taken overlong to gain a more general acceptance The true plastic surgeon, however, does not confine himself to the treatment of minor cosmetic disabilities

The quickening interest of the profession has been shown in a variety of ways Two of the largest and most conservative teaching hospitals in London have established plastic departments, and the day may yet come when every teaching hospital has attached to its staff a surgeon capable of dealing with these problems Thus the student may gain a first rate knowledge of the supreme importance of the fundamental principles of surgery He can learn to appreciate the finer points of surgical craftsmanship, such as the virtue of gentleness in the handling of living tissue, of rigid asepsis, hemostasis, and accurate apposition without tension in wound suture He may even be led to speculate upon the relationship between surgical trauma and the never ceasing wonder of the healing process, and why differences in technique can lead to such startlingly divergent results Its value to the community has been demonstrated by the Plastic Unit established by the London County Council, by services in a variety of intermediate hospitals throughout London, and in the provinces, under the leadership of the Clinic in North Staffordshire, by others in Birmingham and in Manchester It would be easy to visualize a service as efficient though possibly not so far

reaching as that carried on throughout the country by orthopedic surgeons. This specialty will develop in the future, but its progress as in the past will be slow, for it will probably appeal to the few—to those who have a love of craftsmanship and artistry, and to those who are willing to submit themselves to the arduous training of hand and eye necessary for its successful performance.

It is within memory that certain members of the profession looked askance at this struggling infant, judged it marasmic and prophesied for it a sickly adolescence and an early

decline. It is safe to say, however, that in the face of much uninformed criticism reconstructive and reparative surgery is based on sound principles, amply fulfills the best Hunterian traditions, and is today firmly established. The widespread interest created by the Second European Congress of Plastic Surgery recently held in London showed conclusively that the time has come when this specialty may be regarded as completely divorced from the general surgical field. Its future would appear to be assured.

London, England. ARCHIBALD H. MCINDOE



MASTER SURGEONS OF AMERICA

FRANK DORMER JENNINGS

DURING his life Frank Dormer Jennings won a full measure of appreciation. Time but makes us more keenly aware of our loss. Loved and trusted by his fellow physicians in Brooklyn because no man in the history of Brooklyn medicine ever did more for them, he was widely known about the country, too. Of distinguished presence, easy authority and ready verbal rejoinder, he was thoroughly at home anywhere he happened to be. His knowledge of social and economic problems, his interest in legislation and sports multiplied his friends without end, with an unusually retentive memory, there were few subjects on which he could not discourse. A real leader with a vigorous and critical mind, decided views, and colorful personality he was an able surgeon and a fine citizen. A charming humanist, nothing in America was alien to him,

*"Whose power shed round him in the common strife
Or mild concerns of ordinary life
A constant influence a peculiar grace"*

Frank Dormer Jennings was born in Corning, New York, on June 19, 1880. His father, James N. Jennings, was born in Mt. Morris, New York, and his mother, Catherine Dormer, was a native of Corning. He was graduated from the Corning Free Academy in 1897 and from the College of Physicians and Surgeons, Columbia University in 1902. His interne years were passed at St. Catherine's Hospital, Brooklyn, where, after long apprenticeship, he later became attending surgeon. This was the only active hospital appointment he held at the time of his death, although he was still consulting surgeon to the Mary Immaculate Hospital, Greenpoint Hospital and Menorah Home. At Greenpoint, a municipal hospital, he had been attending surgeon for over ten years. St. Catherine's, however, he called his workshop and he loved that hospital more than life itself, only a few hours before his death, he made his rounds in his usual painstaking way.

On October 27, 1913, he married Hannah Cecilia McCarthy. Three children, Frank, Catherine and Joan, blessed their very happy marriage. Catherine's untimely death took heavy toll of him. His devoted wife, Joan and Frank, a student at the Long Island College of Medicine survive him. A tender and understanding husband and father, he loved his home and family.

Master surgeon and keen diagnostician, wisdom, conservatism, good judgment, knowledge of the experience of others and frequent critical evaluation of



FRANK D JENNINGS
1880-1934

his own work distinguished his surgery. Neither a spectacular nor a rapid operator, his work was characterized by thorough study of his patients, a fine knowledge of anatomy, attention to details, perfect technique and a gentle deliberateness in which every motion attained its purpose without loss of time.

A father to the young men about the hospital, he guided them, urged them to higher endeavor, and never tired of finding professional opportunities for them. Of unimpeachable integrity, the shining example of all that a surgeon should be, he trained his associates well. He insisted upon their attendance at medical meetings, membership in scientific societies and required of them constant watchfulness over their end-results. In his conferences with his associates, his hearty laughter tempered the sharp edge of his criticism.

Not a prolific writer, he made many important contributions to medical literature. His profound knowledge of hernia in all its phases grew out of his lifelong interest and wide experience in its management. He wrote well, as he talked, with clear incisive diction. The records of all his operations were written in his own clear characteristic hand. In the same way he recorded the progress of every patient. For many years his records have been an inspiration to the entire staff. All day long was nothing to him in his work in the public wards, he spared neither time nor pains in his work.

For ten years clinical professor of surgery at the Long Island College of Medicine, he was an exceptional teacher. Intensely practical, endowed with a vast fund of common sense, he possessed to an unusual degree the art of awakening the interest of his students. Intending to stimulate them to lifelong participation in the problems of organized medicine, he never failed to arouse in them a newly found sense of civic responsibility.

His great talent for organization found expression in the early years of the Catholic Hospital Association and in the American College of Surgeons. He gave freely of his time and energy to hospitals everywhere, for far and wide they asked him to address their staffs and discuss with them the new problems of standardization which, fifteen years ago, had suddenly become so momentous. He presided over hospital standardization conferences of the American College of Surgeons in Boston, Philadelphia and Chicago, and demonstrated for the College a model staff conference at its meeting in New York. He had brought the staff conference to Brooklyn, and, in his own hospitals, had molded its form and brought to it the courage, fair mindedness, and love of truth so characteristic of him.

When the Medical Society of the County of Kings celebrated its centenary in 1902 he was elected president, the highest honor that could come to any physician in Brooklyn. That venerable society was awakened to new life, for his capacity for work was tremendous and his enthusiasm was contagious. His inspiring leadership carried all with him, for his sincerity and vision were never

questioned. He widened the sphere of influence of the *committee on public health* and won a place for medicine in the discussion of civic problems, he set up a responsible reference committee for the press, and he made postgraduate education available to every doctor in Brooklyn without cost and without leaving home or practice. This he accomplished by means of a joint committee of the Medical Society and the Long Island College of Medicine. This plan has been in successful operation for fourteen years, and, known as the Brooklyn Idea, has found favor elsewhere. One of the first to arouse the medical profession to the importance of stemming the tide of ominous legislation which threatened to overwhelm us, in organized medicine he blazed a yeoman's path.

His activities were not restricted to the terrain of medicine. He continually pointed out that the physician must never forget his responsibilities and duties as a citizen. For himself he answered every call of civic organizations, and a great many demands were made upon him. As chairman of the Public Health Committee of the Brooklyn Chamber of Commerce his work was notable. Although he always complained that it was not an easy task, he was most at home making an after dinner speech, for he was never dull, and he loved a joke, his sallies were eagerly awaited by his audience. Absolutely at ease, he was always himself, never at a loss for words and his perfect turning of points was always *effective*.

For his lips could well pronounce
Words that were persuasions

Even his triumph over the physical threat which hung over him was an inspiration to us all. Fear was not in him,—the habit of hard work was. On January 26, 1934, at the peak of his personal and professional prestige, he died in the harness of his beloved profession, as he would have wished, at his desk in his office. His death was typical of his service to the community.

To live in hearts we leave behind
Is not to die

CHARLES A. GORDON

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE second volume of the *Atlas of Pathological Anatomy*¹ issued under the direction of the editorial committee of the *British Journal of Surgery* and compiled by E. K. Martin in keeping with its predecessor, volume 1, presents a collection of illustrations of pathological conditions. The majority of the 250 to 300 figures are in colors, and since they are mainly executed by Sewell and a few by Maxwell and Terzi, their quality is excellent. The illustrations are well grouped into sections dealing either with systems such as the joints, or with organs, such as the thyroid or tongue. Especially interesting and valuable are those dealing with the pharynx and esophagus and with the genito-urinary system, particularly the testis. Each group of figures is preceded by a succinct description of the general pathological features of the special field, while each figure is accompanied by clinical and pathological description. The book provides a liberal education in special pathology and should serve as an excellent source book for illustrations not only of common but of rare pathological conditions. The publishers are to be congratulated on the excellency of their illustrations.

MICHAEL L. MASON

THE author of *Hautdesinfektionsprobleme*² determines the efficacy of skin disinfection following the usual methods of surgical scrubbing and hand preparation. Cultures were made from the hands of some seventy physicians and nurses, from several scrub-women and a number of patients, before and after various methods of scrubbing and types of antiseptic baths. Bichloride of mercury solution, while the most powerful antiseptic, was also the most irritant to the skin and could not long be used. Phenosalyl, while not so irritating, was found to be less efficient, while soap spritzes were found occasionally very efficient, but often irritant. The simpler method of surgical scrubbing with soap for 6 minutes, followed by 4 minutes of soaking in 90 per cent (not 70 per cent) alcohol, appeared to yield fairly consistent and satisfactory results. The author does not draw any very definite conclusions, nor does he make any specific recommendations concerning methods of preparing the hands for surgery, but one is left with the impression that he favors a brief scrubbing with soap and water, followed by 4 to 6 minutes of soaking in 90 per cent alcohol.

¹ATLAS OF PATHOLOGICAL ANATOMY, ISSUED UNDER THE DIRECTION OF THE EDITORIAL COMMITTEE OF THE BRITISH JOURNAL OF SURGERY. Compiled by E. K. Martin, M.S., F.R.C.S. Vol. 2. Baltimore: William Wood & Co., 1935.

²HAUTDESINFESTATIONS-PROBLEME. By Jørgen Ernst. Copenhagen: Levin & Munksgaard, Ejnar Munksgaard, 1937.

No attempt is made to correlate the findings with any clinical data or to evaluate the significance of positive cultures taken from the skin. In none of the methods used were sterile hands always obtained and we must conclude that the same situation obtains in any of the usual methods of hand preparation. Such observations serve to emphasize again the fact that sterility of the operative field is relative and that what matters most is that the number of bacteria be not too great, nor their virulence too high, and that the host's resistance is not too badly interfered with. MICHAEL L. MASON

AS IN previous years *The Year Book of Radiology*³ provides the medical profession with abstracts of the most significant contributions to the year's literature. The material used has been well selected and includes many contributions from foreign countries. The editorial comments are concise and greatly enhance the value of the volume.

Naturally, not all of the material is completely new but one cannot help but note the newer concepts and methods as well as the expansion of the field of roentgenology. The correlation of clinical knowledge with roentgen interpretation becomes more and more important as the scope of the specialty broadens.

The use of contrast materials has become more widespread so that almost all body cavities have been visualized. Mammography and the demonstration of rupture of the intervertebral disc into the spinal canal after lipiodol injection are among the newer methods.

It is impossible, of course, adequately to review a volume of this type. Suffice it to say that all divisions of roentgenologic diagnosis—osseous, glandular, respiratory, cardiovascular, gastro-intestinal, genito-urinary, obstetrics, gynecology, and nervous system—are adequately covered in a most interesting manner.

Kaplan begins the section of radiotherapeutics with a discussion of the cancer problem as a whole. This is followed by chapters dealing with radiation biology and physics. The division of the material into the various specialties makes it particularly valuable as a reference volume. As was noted in diagnosis, the field of radiotherapeutics is expanding. The beneficial effect of radiation on inflammatory tissue can no longer be doubted. Super-voltage x-ray therapy has not as yet proved to be of sufficient value to warrant universal use and the enormous expense of installation.

³THE 1937 YEAR BOOK OF RADIOLOGY. DIAGNOSIS. Edited by Charles A. Waters, M.D., Associate editor, Whitmer B. Finner, M.D. THERAPEUTICS. Edited by Ira I. Kaplan, B.Sc., M.D. Chicago: The Year Book Publishers, Inc., 1937.

The *Year Book of Radiology* has established itself as a valuable addition to the library of anyone interested in roentgenology. It is used by the reviewer regularly and is recommended without reservation.

EARL E. BARTH

WARREN praise should be given to *The Roentgenologist in Court*, a book which is very comprehensive yet easy to read. Lawyers as well as physicians should find in it a mine of information and a helpful guide in the preparation and conduct of medicolegal cases. The reviewer has consulted a number of leading attorneys who agree that the work, especially chapters 4, 7, 9, 10 and 13, cover the fundamental principles which lawyers and doctors as a class sometimes do not readily understand. Chapter 13, Doctor take the stand, is most impressive if physicians would read this chapter they would get over the mental hazard which is explained so well. Malpractice actions are on the increase. Many of them are based on the false economy which led the physician first handling the injury case to dispense with x-ray studies. Repeated decisions affirm that the use of x-rays is mandatory in the treatment of fractures. An important chapter concerns prophylaxis against malpractice suits. The purchase of this book would be a wise investment for any physician.

JAMES T. CASE

IN HIS book regarding genito urinary abnormalities Dr. Young presents his experiences in a most interesting field of medicine. These experiences are unique and are probably unequaled by anyone in this particular field. It is difficult to conceive of one man's having amassed such an extremely interesting and yet diverse group of cases during his professional career.

With his usual painstaking care and meticulous attention to detail Dr. Young has given us one of the most interesting and valuable books that has been published for many years.

The subject of hermaphroditism is presented in an elaborate manner in fact it may be said that Dr. Young's presentation is classic. Before discussing the subject of hermaphroditism proper the author has quite correctly and in detail presented a chapter on the embryology of this condition. The subject is presented in four chapters that deal with pseudohermaphroditism, female pseudohermaphroditism, true hermaphroditism and hermaphroditism with the sex undetermined. Case histories, illustrations of patients and illustrations of the various operative procedures are given with great care.

An interesting and instructive chapter is the one that deals with vaginal abnormalities in hermaphroditism. The chapters dealing with adrogenital

syndrome, prostates in females and hypogonitalism and hypergonitalism are given in a masterful fashion. Some of the more common malformations of the urinary tract such as hypospadias, epispadias, ectrophy of the bladder and congenital valves in the prostatic urethra are also included.

The final chapter deals with the relationship of the genital tract to the endocrine glands and a discussion of endocrine therapy is given.

This book will serve as a standard reference for many years to come not only for the urologist but also for the gynecologist, the general surgeon, the pediatrician, the endocrinologist and the embryologist.

The text is beautifully and profusely illustrated and no attempt has been spared in the way of illustrations of which there are more than five hundred.

HERMAN L. KRETSCHMER

THE sixth edition of *The Science and Practice of Surgery* by Romanis and Mitchner is now available. It is a comparatively new work, the first edition appearing in 1927, and since this is the fifth edition it would seem that the authors are giving the work adequate attention so that it may be an accurate expression of the ever advancing science of surgery. Numerous additions and alterations may be found in the new edition in comparison to the fifth which appeared in 1934. Noteworthy are the revisions of the chapters on fractures and dislocations, x-ray and radiation therapy, anesthesia and genito urinary disease. The section on the sympathetic nervous system has been completely rewritten. It has been the privilege of the reviewer to watch this work pass through its various editions and revisions and to note how thoroughly the material is being checked. Errors and misstatements will creep into any work of the magnitude of this system which consists of approximately 1800 pages; moreover differences of opinion will be ever present. Such differences of opinion are a stimulant to progress and reflect a healthy state of the profession.

This work is comprehensive and although the information given on any one topic of necessity is limited in scope, a tremendous amount of material is accumulated in a concise form. Specific details in treatment are often lacking and vague and for that reason the inexperienced reader may be misled at times. It is true that to complete all surgical subjects would require an almost endless amount of book space. There may be found however state-ments which are questioned. In describing the treatment of peritonitis with excessive vomiting the authors state the absence of which (bile) from the cecum is a potent cause of paralytic ileus. Further along it is stated a jejunostomy may be performed and the bowel washed with warm sterile saline with advantage. For the treatment of acute

THE SCIENCE AND PRACTICE OF SURGERY By W. H. C. Romanis and M. A. Mitchner. 15th ed. P. B. C. S. (Ed. 1) and P. B. C. S. (Ed. 2) 1937. P. B. C. S. (Ed. 1) and P. B. C. S. (Ed. 2) 1937. 15th ed. London: J. & A. Churchill Ltd. 1937.

THE ROENTGENOLOGIST IN COURT By S. must Wright Donaldson A. B. M. D. F. A. C. R. 26th ed. 1937. Ch. C. C. S. (Ed. 1) 1937. CENTRAL ABNORMALITIES OF THE ORGANS AND RELATED ABNORMALITIES By Hugh Hampton Young M. A. M. D. S. C. D. F. R. C. S. 1937. Baltimore: The Williams & Wilkins Co. 1937.

gonococcal salpingitis it is recommended "This consists of laparotomy, squeezing out the pus from the inflamed tubes which should not be removed, and mopping out the pelvis with sterile plugs" Attention is called to such statements in the hope of stimulating thought upon the subjects, since the conclusions are at variance with the consensus in the United States. It is noted that no great stress is placed upon intestinal decompression by tube, and an accurate control of water and blood chloride balance in the treatment of intestinal obstruction. In the States the treatment of intestinal obstruction is summed up by Wangenstein as follows: saline solution, blood transfusion, decompression by tube and operation. Transurethral electric resection of the prostate is not mentioned, although reference is made to the excision of wedge-shaped portions of the prostate.

The chief value of this system, from the reviewer's viewpoint, is that here are assembled brief descriptions of practically all the surgical conditions known to man. For the student, therefore, it is a valuable reference work.

JOHN A. WOLFER

BY FAR the best and clearest statement of Pavlov's experiments, observations, and ideas pertaining to conditional reflexes and experimental neurosis that has been made available is contained in the book, *Pavlov and His School*.¹ The method of presentation and mode of expression are delightful. The photographs and illustrations are very helpful in elucidating a complex subject. The book reads easily and the biographical sketch of Pavlov and, in fact, the entire book is truly fascinating and inspirational.

¹PAVLOV AND HIS SCHOOL. THE THEORY OF CONDITIONED REFLEXES. By Prof. V. P. Pavlov, M.D. Translated from the Russian by C. P. Dutt, B.A. (Cantab). New York: Oxford University Press, 1937.

Every medical student, biologist, and physician should read the book. To one who has had any contact with science, this book will prove to be more pleasant literature than the best novel, analytical story, or adventure tale.

A. C. IVY

THE second volume of Duke-Elder's *Textbook of Ophthalmology*² has been published—Volume 1, the Development, Form and Function of the Visual Apparatus, was published in 1936. Those familiar with the first volume have awaited the appearance of volume 2 with great interest and, although they appreciate the tremendous task involved, hope that the succeeding volumes will appear shortly.

As stated in the preface of the first volume, the author's purpose is to make available in the literature, a reference textbook of ophthalmology. This he has certainly done. A brief historical sketch of a pre-eminent figure in the field to be discussed is given and the presentation of the subject matter is straightforward, concise, yet adequate. Both sides of controversial questions are presented and the author gives his own viewpoints with his reasons for them. An inclusive up-to-date bibliography is included for each topic. A wealth of easily accessible material is contained in the volume, not only is each topic thoroughly discussed, but topics which in the ordinary text are merely mentioned, here are fully treated. Perusal of volumes 1 and 2 gives convincing proof that with the volumes yet to come the field of ophthalmology will be fully and thoroughly covered by Sir W. Steward Duke-Elder.

This *Textbook of Ophthalmology* is to be highly recommended.

WILLIAM H. DROEGEMUELLER

²TEXTBOOK OF OPHTHALMOLOGY. By Sir W. Steward Duke-Elder, M.A., D.Sc. (St. And.), Ph.D. (Lond.), M.D., Ch.B., F.R.C.S. Vol. 2—Clinical Methods of Examination, Congenital and Developmental Anomalies, General Pathological and Therapeutic Considerations, Diseases of the Outer Eye. St. Louis: C. V. Mosby Co., 1938.

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A SYNOPSIS OF THE DIAGNOSIS OF THE ACUTE SURGICAL DISEASES OF THE ABDOMEN By John A. Harley, B.Sc., M.D., F.A.C.S. St. Louis: The C.V. Mosby Co., 1938.

ASSOCIATION FOR RESEARCH IN NERVOUS AND MENTAL DISEASE. Vol. XVII of a Series of Research Publications. THE PITUITARY GLAND: AN INVESTIGATION OF THE MOST RECENT ADVANCES. The Proceedings of the Association

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MATERNAL CARE COMPLICATIONS: THE PRINCIPLES OF MANAGEMENT OF SOME SERIOUS COMPLICATIONS ARISING DURING THE ANTEPARTUM, INTRAPARTUM AND POSTPARTUM PERIODS Approved by The American Committee on Maternal Welfare, Inc. Prepared by R. D. Mussey, M.D., P. F. Williams, M.D., and F. H. Falls, M.D., F. L. Adair, M.D., Editor. Chicago: The University of Chicago Press, 1938.

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CORRESPONDENCE

THE DANGER OF THE INTRAVENOUS DRIP

To the Editor: For several years I have been inveighing against the use of the drip apparatus in intravenous injections. The drip device which permits counting the drops has no really useful function and is dangerous. The rate of flow of the fluid into the vein can be much better determined by placing a little strip of adhesive plaster at the level of the fluid in a graduated glass container and noting the amount of fluid that has gone into the vein within a definite period of time. The flow can then be regulated by a thumbscrew clamp on the rubber tube.

The objections to the 'drip' device are:

1. It is unnecessary and complicating.
2. The rate of flow can be even more accurately ascertained by the method mentioned for drops are not always of the same size.
3. There is a distinct danger of air embolus. When the patient is straining or coughing the pressure in the veins is high and the back pressure on the drip device compresses the air in it. When the straining suddenly ceases and the flow through the intravenous needle or cannula becomes rapid, air may be sucked over into the veins. Often this is of no great importance, but it seems probable that those who have

reported a large incidence of pulmonary emboli and thrombi following intravenous injections will find it due chiefly to this drip method. The air may form a nucleus for a thrombus.

In this connection the report of a necropsy by Dr. K. L. Terplan before the Buffalo Pathological Society¹ is interesting. It is as follows:

A year old white girl known to have been suffering from congenital heart disease became severely ill with pneumonia, hemorrhagic pleuritis and erysipelas. The general condition of the child was very poor. After an intravenous drip of 3 per cent dextrose solution had been concluded, the child died suddenly. The attending pediatrician expected an embolic cause for the sudden death.

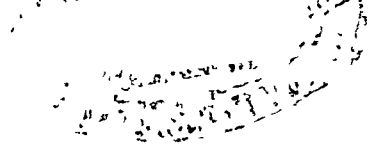
In this case all the air was trapped completely in the main stem of the pulmonary artery which contained typical pinkish white foam but neither fluid blood nor clots. There was a distinct fusiform distention of the main stem of the pulmonary artery. The right ventricle and the right atrium contained only fluid blood and a few thin clots. (The post-mortem examination was performed about 7 hours after death.) In the major branches of the pulmonary artery there was mostly fluid blood with hardly any foam.

An apparently small amount of air had sufficed to bring about immediate death in a child suffering from pneumonia of the left pleural cavity, marked pressure atelectasis and diffuse bronchopneumonia of the right lung.

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Richmond, Virginia

T. Arch. Path. 1, 936, 22, 756



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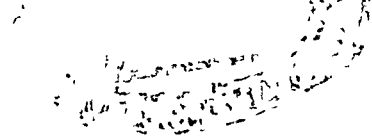
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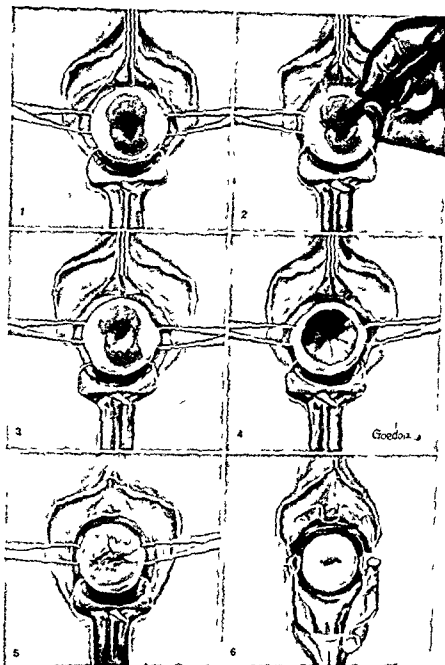


PLATE I: 1. Frosion of the cervix 2, 3, 4. Illustrating technique. Depth and amount of tissue removed may be regulated as required. 5. Cervix three weeks after conization. 6. Cervix six weeks after.

(Conization of the Cervix — Norman F. Miller in J. Oliver E. [ed.]

SURGERY

GYNECOLOGY AND OBSTETRICS

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CONIZATION OF THE CERVIX

NORMAN F. MILLER, M D , F A C S , and OLIVER E. TODD, M D , Ann Arbor, Michigan

FROM earliest antiquity, heat in one form or another has been held in high esteem as a therapeutic measure. Moodie (1920) speaks of cauterization of the scalp as practiced in neolithic times in France and later in central Asia, Canary Islands, Europe, and Peru. Hoppe (1847), writing on fire as a healing medium, states that fire was used by Hippocrates, Albucasis, Severins, and later by Percy, Larrey, v Kern, and Rust. Methods of application varied. Use of the direct flame by burning spiritus on the wound or afflicted area belongs to earlier times. According to Hoppe, the most famous preparation for the application of intense heat was of Chinese and Japanese manufacture. It was made chiefly from dried leaves of Chinese wormwood and called "moxa," a term now applied to any substance used for this purpose. The Mongolian races preferred cotton for moxa. They formed cylinders of cotton and burned them on the flesh for about a quarter of an hour. Nearly every ailment was treated by fire or heat and often by means of the hot iron. Probably the original burning materials were hemp, flax, oakum, and sponge. Hippocrates used oakum and sponge.

Jobert de Lamballe (1843) was probably one of the first in later centuries to advocate and practice treatment of the ulcerated cervix by use of the glowing iron. This procedure has

been recommended by Percy in his "Pyrotechnie chirurgicale ou l'art d'appliquer le feu en chirurgie," Paris, 1811, but apparently was not extensively used by him. Jobert (de Lamballe) stressed the lack of pain during cautery of the cervix and attributed this to the absence of nerves in this organ. Years later the Germans, notably Brandes, did much to popularize this method of treatment in their native country. The danger and discomfort from burning the vaginal mucous membranes were well known and the use of an ivory or wooden speculum during the cauterization followed by a douche of cold water was generally accepted as the correct procedure. While chemical cauterization has repeatedly risen to temporary favor, it has never received the prolonged acclaim accorded actual cautery.

In 1906, Hunner suggested treating cervical disease by means of deep radial cauterization. In 1911, Dickinson commenced using the fine nasal tip cautery for the same purpose and since 1920 this form of treatment has become generally accepted. While local cauterization of the cervix is not without drawbacks, the good accomplished through its proper use far overbalances its shortcomings. With increased interest and extended use it is only natural that modifications should occur and today there is available another valuable procedure for use in preventive, as well as remedial, gynecology, namely, electrosurgical cutting and coagulation. Procedures of this type

From the Department of Obstetrics and Gynecology, University of Michigan, Ann Arbor, Michigan

are now being carefully appraised for their real value and it is with the hope of aiding in this appraisal that we submit this report on electrosurgical conization of the cervix.

Our study is based on 899 conizations performed at the University of Michigan Hospital during the past 4 years. The technique used in these cases is illustrated in Figures 2, 3, and 4. At first this was done as either hospital or office procedure, under gas anesthesia. Today we prefer to hospitalize every patient for 3 or 4 days. When the cutting current is properly combined with coagulation, the operation becomes a bloodless procedure—and in this respect is in striking contrast to most cervical amputations, particularly the Sturmdorf operation. It takes about 6 weeks for complete epithelization to occur following conization. It is our custom to guard against stricture during this time by placing an iodoform wick in the cervical canal at the time of operation in all patients except those who are to have a subtotal hysterectomy. This wick is removed on the third day and the patient is discharged with instructions to take a daily cleansing douche and report biweekly for check up examination. At this time the cervix is painted with an antiseptic and a sterile sound or hemostat is passed into the canal. This procedure is repeated at 2 week intervals until epithelization is complete. After years of experience and careful follow up of our cases we feel that extensive conization is not to be viewed as a substitute for simple cauterization, coagulation or other valuable means of treating benign cervical disease. On the other hand, the benefits from extensive conization are real and it should have a place in everyday gynecological surgery.

INDICATIONS

Our indications for conization have fluctuated somewhat during the period covered by this study and a wide variety of benign cervical disease has been treated by this method. Briefly stated, our present indications for using this method of treatment are:

- 1 As a means of correcting minor cervical disease and preventing remote complications of the cervix in patients for whom subtotal hysterectomy is planned

- 2 As a means of eradicating deep seated, chronic infections of the cervical canal in older women

- 3 As a complete substitute for the Sturmdorf operation in any condition of the cervix for which the Sturmdorf operation is indicated

- 4 As a means of obtaining adequate biopsy material in cases in which original biopsy material presented cytological abnormalities strongly suggesting neoplastic change

- 5 As a substitute for older methods of trachelorrhaphy in most women but especially in elderly women

It is difficult not to become enthusiastic over the use of conization and we feel a word of caution is justified for the procedure is not without drawbacks. Extensive conization as here described is a hospital procedure and should be reserved for the more severe types of cervical lesions.

RESULTS

No serious immediate complication occurred in any of the 899 conizations comprising this study.

During the first few days there is little discharge and no discomfort but commencing third or fourth day the discharge becomes profuse and is often bloody. Normally this serosanguineous or bloody discharge persists for 2 weeks after which it gradually decreases. Vaginal cleansing douches are essential during this healing period, the type of douche making but little difference. Ultimate healing with complete epithelization renders the cervix clean and normal in appearance. In a few patients small areas of delayed epithelization are noted. In these, healing may be hastened by the use of the fine nasal tip cautery.

Of real interest are the late results following conization. Our follow up study includes only those patients operated upon more than 6 months previously. In the majority from 1 to 3 years have elapsed—ample time for stricture and other complications to develop. A total of 393 (Table I) patients answered questionnaires (or 70 per cent of those eligible for stricture etc.). Data so obtained are shown in Tables I, II and III.

The figures in Table II represent all strictures which have come to our attention.

TABLE I—GENERAL DATA

Conizations done before menopause	747
Conizations done after menopause	152
Total	899
Number eligible for stricture (does not include patients hysterectomized or castrated regardless of method)	557
Multipara (per cent)	93.1
Nullipara (per cent)	7.8
Number of patients answering questionnaires	393
Average age—years	40
Average time lapsed since conization (questionnaire)—months	14
Average duration bleeding or blood tinged discharge, after conization (questionnaire group)—weeks	2.7
Average duration discharge* after conization (questionnaire group)—weeks	11.1
* This includes all discharge regardless of source and degree	

TABLE II—INCIDENCE OF STRICTURE

	Number	Per cent
Positive stricture (returned for treatment)	36	6.46
Probable stricture (suggested in letter or questionnaire)	14	2.51
Total	50	8.97

since we commenced using this procedure in February, 1932, and do not therefore truly represent the stricture incidence today. With greater care during the healing period the number of strictures have decreased. This is particularly true of the more severe type wherein the entire canal is obliterated and replaced by a dense cicatrix.

The majority of strictures were mild and required only dilatation or passage of a sterile sound or hemostat.

The fact, however, that strictures do occur, some of them severe, warrants care in the selection of cases and careful observation afterward.

While the number of pregnancies subsequent to conization in this series is small, the trend certainly suggests a harmful influence on subsequent pregnancies. This is seen to be in the direction of abortion and premature labor rather than cervical dystocia as might have been anticipated. This tendency to early interruption of pregnancy is another drawback and suggests its use only in women past the childbearing period, and even then we do not consider it a substitute for the less radical office procedures in *mild* cervical disease.

TABLE III.—EFFECT UPON PREGNANCY

	Number	Per cent
Number of cases	22	
Spontaneous delivery at term	8	36.3
Premature	4	18.1
Abortions	3	13.6
Still undelivered	7	31.8
Other complications—		
Threatened abortion—3 months	1	
Placenta praevia—7 months, dead baby	1	
Average age—years		30

TABLE IV.—PATHOLOGY OF CERVICAL TISSUE REMOVED

	Number
Cervical erosions and/or glandular erosions, and/or polypoid glandular erosions	562
Hyperplasia and/or hyperkeratosis and/or cornification of squamous epithelium	347
Cervicitis of all types, acute and chronic (catarrhal, mucopurulent, etc.)	97
Endocervicitis, all types, acute and chronic (catarrhal, mucopurulent, etc.)	651
Glandular hyperplasia and/or polypoid hyperplasia and/or polypoid glandular hyperplasia	318
Cervical ulcer with or without pyogenic granulation tissue base	66
Dilated and/or cystic glands	481
Fibrosis	183
Polyps (of cervix)	60
Malignancy of the cervix	20
No pathology in cervical tissue examined	3
No diagnosis possible because of coagulation of tissue (early cases)	4

EVALUATION

Electrosurgical conization of the cervix appears to have a real place in gynecology. As a means of treating stubborn chronic cervicitis in women past the childbearing age, it far surpasses any other procedure known to us short of total hysterectomy. The excision of gland bearing tissue can be made complete although such extensive conization is probably not often necessary. We have found it a satisfactory substitute for the Sturmdorf operation and for most trachelorrhaphies.

SUMMARY AND CONCLUSIONS

We believe that our experience with this operation justifies certain general conclusions:

1. Conization of the cervix as here described is a valuable, safe, rapid, and eminently satisfactory way of treating the *more extensive benign lesions of the cervix in older women*.
2. In general its use should be limited to women past the childbearing age and even in

this group should not be looked upon as a substitute for the less radical office procedures now in use in the treatment of simple cervical disease.

3 Conization is many times faster, simpler, and a bloodless substitute for—and in our clinic has completely replaced—the Sturmdorf operation. The amount of tissue removed can be controlled and conization equals in efficiency any means of cervical gland reaming now available. Ultimate healing is but little slower than in the Sturmdorf procedure and the incidence of severe stricture probably no greater.

4 Conization is a desirable quick and convenient method of treating the cervix prior to subtotal hysterectomy.

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TUBERCULOUS PERITONITIS

An Analysis of 257 Cases

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THIS paper is based on a series of 257 cases of tuberculous peritonitis obtained from medical and surgical records of the following hospitals Bellevue Hospital, New York, Children's Hospital, Boston, Flushing Hospital, Flushing, Long Island, Massachusetts General Hospital, Boston, Peter Bent Brigham Hospital, Boston, New Haven Hospital, New Haven, New York Hospital, New York

Tuberculous peritonitis is most prevalent during early life

Holt states that Still found the largest number in the second year of life in a series of one hundred cases

It is generally accepted that the peritonitis is secondary to a tuberculous infection elsewhere in the body, although the primary focus of the disease may not be diagnosed Usually, the original tuberculous site is in the intestines, lungs, lymphatic nodes (mesenteric, bronchial), fallopian tubes, or more distant structures

PATHOLOGY

Tuberculous peritonitis may be acute or chronic The acute form is rare The peritoneum is involved as part of a generalized

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TABLE I — AGE INCIDENCE

Age in years	Number of patients	Per cent
1-10	115	46
10-20	46	18
20-30	42	17
30-40	14	6
40-50	18	7
50-60	6	2
60-70	2	1
70-80	1	0
Total	257	100

miliary tuberculosis Tubercles small in size are scattered over both the parietal and visceral peritoneum The tubercles may alone be present or with a serofibrinous or bloody exudation which is rarely large in amount. This form is seldom observed for there are no abdominal symptoms

The chronic form is classified into different varieties according to anatomical or clinical resemblances McPhedran and Peacock suggest the following forms

1. Ascitic
2. Loculated encysted or fibro-plastic variety
 - a. Suppurative or ulcerated
 - b. Ascitic
3. Chronic fibroid—adhesive or obliterative form

In the ascitic form the peritoneum is studded with miliary tubercles, both discrete or in conglomerate masses and are found on the viscera, omentum, and mesentery The fluid (amber or straw-colored serum, seropurulent or bloody) is freely established in the peritoneal cavity

In the loculated encysted variety the intestines are matted together by adhesions Because of the adhesions there are enclosed collec-

TABLE II — TUBERCULOSIS ELSEWHERE

Anatomical structure involved	Cases	Per cent
Lungs	49	19
Lymph nodes	23	9
Bone	7	2.7
Epididymis	7	2.7
Fallopian tubes	5	2
Meninges	5	2
Skin	3	1.1
Pericardium	2	0.8
Questionable	14	5.4
Negative	142	55
Total	257	100

TABLE III — OPERATIVE FINDINGS

Cases reported	Spi s nd St benb rd		McPhedran and Peacock	
	257		21	
Patient operated upon	272		6	
	Times	Per cent	Times	Per cent
Tubercles	106	6	4	66
Adhesions	50	20	4	66
Free fluid	73	47	3	50
Caseous nodes	13	10	1	16
The thickened peritoneum	16	0	2	16
Nodules (large)	15	8	1	16
Salpingitis	5	2		
Appendicitis		2	1	16

*Thirne (5) in discussing tuberculous appendicitis considers the two main types (1) tuberculous peritonitis (2) more common ulcerative appendicitis and (3) hyperplastic type

tions of fluid. In the more advanced stages there are intraperitoneal abscesses and caseous areas. The tuberculous process may infiltrate the intestinal walls thus causing them to perforate.

In the chronic fibroid form are seen large amounts of fibrous tissue with extensive adhesions involving the layers of the peritoneum (usually thickened), the omentum (often rolled on itself), the intestines, and the solid viscera. Separation of the various structures is difficult at the risk of perforation of the hollow viscera. On examination the tumor masses are found palpable through the abdominal wall.

Operations were performed in 171 cases revealing the pathological conditions shown in Table III.

The signal symptoms and signs were referable to the gastrointestinal tract. Because of the large series of cases reviewed we believe that these findings are significant. The diagnosis of tuberculous peritonitis becomes easier and may be made more frequently when these relationships are borne in mind.

A careful and routine physical examination should be made (being ever alert for the primary focus) and the adjuncts blood, fluid, sputum, stool, and urine examination for the isolation of the tubercle bacillus, tuberculin tests, guinea pig inoculation, history of exposure (familial), and roentgenograms (lungs, skeletal) should be taken whenever tuberculous peritonitis is suspected.

TABLE IV — SYMPTOMATOLOGY

Symptom	Times	Per cent
Abdominal pain	175	77
Abdominal swelling	165	66
Vomiting	70	30
Constipation	59	21
Loss of weight	40	16
Fever	45	17
Diarrhea	30	15
Exhaustion	25	10.3
Cough	26	9
Weakness	3	7.7
Anorexia	18	7
Nausea	17	4
Headache	17	4
Dysuria, hematuria, pollakiuria	10	3.5
Splenomegaly, appendicitis	8	3.1
Unilateral testicular obstruction	6	2.3
Tympanites	7	2.7
Foul vaginal discharge	4	1.5
Stupor	4	1.5
Bloody stools	3	1.1
Swelling in groin	3	7
Tenesmus	2	7
Hiccough	1	4

We regret that tuberculin tests, guinea pig inoculation results, did not constitute part of the routine examination in our series. At times they were tabulated but often as not were not done. Of the 257 cases collected 20 patients had a positive exposure (familial); history, 147 patients gave a negative exposure history and probability of exposure was unknown in 90 patients.

DIAGNOSIS

Oster writes that the diagnosis of these peritoneal masses is difficult. As to the differential diagnosis, cystic ovarian disease and cancer are especially to be considered. The pre-operative diagnosis of appendicitis was made on 4 occasions.

McPhedran declares that abdominal pain associated with low grade fever, exhaustion toward evening, loss of weight, poor appetite accompanied by abdominal swelling with free fluid, constitutes the syndrome of tuberculous peritonitis. Holt mentions irregularity of the bowels. As evidenced by the high incidence of vomiting in our own series we add vomiting as an important symptom.

TREATMENT

Medical. The treatment consists in absolute rest, approved diet, fresh air, heliotherapy or ultraviolet radiation. Furniss advises light therapy combined with general hygienic measures in restoring the patient's health. It is especially satisfactory in the chronic plastic adhesive type cases with localized peritonitis.

TABLE V.—PROMINENT PHYSICAL SIGNS

Distention of abdomen	157	61
Signs of fluid	92	35
Tenderness	71	27
Abdominal mass	70	27
Emaciation	57	22
Pulmonary (râles)	43	16
Abdominal rigidity	32	12
Adenopathy	20	3 8
Doughy feel to abdomen	9	3
Discharging sinus	6	2 7
Enlarged liver	6	2 7
Rectal mass	6	2 7
Hernie (inguinal)	4	1 5
Simulating appendicitis	4	1 5
Pelvic mass	3	1 1
Rigid neck	3	1 1
Borborygmus	2	7
Fecal fistula	2	7
Rectovesical fistula	2	7
Prolapse rectum	1	4

In those patients with ulceration and large caseous lymph nodes it is less satisfactory. Brown and Sampson recommend natural or artificial heliotherapy. A word of caution is given at this time, namely heliotherapeutic exposure in the acute or active (pulmonary) case is dangerous. The following is an outline of the technique used (10), an Alpine sun lamp, first degree erythema, is repeated every 2 to 3 days. The treatment is started with a 3 minute exposure front and back at a distance of 33 to 36 inches, and the time is increased by 1 to 2 minutes at each subsequent exposure, until the maximum exposure is 20 to 30 minutes. The course of the treatment ranges between 2 and 3 months.

Smith states that, following the use of calcium chloride and sunbaths, the fluid may disappear in tuberculous peritonitis.

Surgical. As to the surgical treatment of tuberculous peritonitis, various procedures are used, especially.

- 1 Laparotomy—simple with removal of the fluid and closure of abdomen without drainage
- 2 Removal of foci of infection—appendectomy, oophorectomy, salpingectomy, etc
- 3 Intraperitoneal oxygen insufflation—Stein—which is contra-indicated in (a) acute cases, (b) advanced ulcerated intestinal tuberculosis, (c) in the plastic form
- 4 Intraperitoneal saline at the conclusion of the operation to prevent the formation of adhesions in abdominal tuberculosis
- 5 Operation for intestinal obstruction

McPhedran makes no classification as to medical or surgical treatment.

After a study of the results in our series (Table VI), we are far from encouraged, for

TABLE VI.—RESULTS OF TREATMENT
IN 212 CASES TRACED

	Cases	Per cent	Per cent of traced cases
Improved			
Surgical	98	82	46
Medical	21	18	10
	119	100	56
Unimproved			
Surgical	17	71	8
Medical	7	29	3 5
	24	100	11 5
Died			
Surgical	50	72 5	23 5
Medical	19	27 5	9
	69	100 0	32 5
Total improved	119		56 0
Total unimproved	24		11 5
Total died	69		32 5
	212		100 0
No trace	45		
Total cases in series	257		

there was improvement in 56 per cent (46 plus 10) of our 212 cases, no improvement in 11.5 per cent (8 plus 3 5), and death followed in 32 5 per cent (23 5 plus 9).

The largest number of patients who improved were treated surgically (82 per cent); the patients improved after medical treatment numbered only 18 per cent.

Again, a study of the surgical cases separately shows 59 per cent improved with a mortality of 30 per cent in this group. When those given medical treatment are considered alone we find an improvement in 45 per cent with fatal results ranging up to 40 per cent. The patients showing no improvement were almost constant in both groups.

CONCLUSION

1. Tuberculous peritonitis is a severe and often fatal disease and is secondary to a tuberculous infection elsewhere in the body.

2. The outstanding symptoms in order of occurrence are abdominal pain, abdominal swelling, vomiting, constipation, loss of weight, fever, diarrhea, exhaustion, cough, weakness, and anorexia.

3. The more prominent physical signs follow: abdominal distention, free fluid, tenderness, abdominal mass, emaciation, pulmonary and abdominal rigidity.

4. A review of our series of cases shows that surgery offers the best results in the treatment of tuberculous peritonitis.

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URINARY STRESS INCONTINENCE

The Anatomical Defect Found and a Rational Method for Its Treatment

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URINARY stress incontinence, which is peculiar to women, is much more prevalent than the average person suspects. It is caused by a disturbance of the urethral sphincters which are rendered incapable of retaining urine within the bladder when intra-abdominal pressure is increased. Consequently, a mild cough, straining, laughter, aggressive intercourse, a slip while walking, or urgency of urination cause varying degrees of urinary extrusion. (Strangely enough this disturbance is not listed among complaints of many patients because it is so prevalent among women that it is considered normal.) It is sufficiently inconvenient to wear a pad during the menstrual flow without the added annoyance of again wearing one at a social function, hence the gynecologist should endeavor to understand the pathology of this disturbance which is often the cause of serious psychological disturbances and may be the basis of many inhibitions which prevent a fuller life.

As the urethra, the vagina, and the rectum separately perforate the three muscular layers of the pelvic outlet, a bridge of musculofascial tissue remains between each of the three openings. The structure between the rectum and the vagina is called the perineum, or more properly, the posterior perineal body, while the structure between the urethra and the vagina may be called the anterior perineal body. The continuity of these structures must not be damaged by labor if the efficiency of voluntary urethral control is to be retained.

Incontinence, however, is not always due to anatomical damages produced by labor, for it is frequently found in middle aged women who have not borne children. In this type the urinary defect is only a part of a general physical underdevelopment. The ab-

dominal wall may be relaxed or pendulous and as far as the patient is concerned it is not a part of her voluntary muscular system. These individuals usually are unable to contract the muscles of the abdominal wall, or maintain a state of contraction, with ease, for only a few seconds. In the same manner they are unconscious of a voluntary sphincter of the rectum, which can normally be contracted at will and be maintained in a state of contraction for a short period of time. Many married women are unconscious of a voluntary vaginal sphincter which can be relaxed and contracted at will. Consequently, if an individual is unable to exert voluntary control over such definite muscular bundles, how can she be expected to exert sufficient pressure against the urethral canal to withstand increased abdominal pressure and prevent leaking?

During pregnancy, the area between the bony boundaries is estimated in order to determine whether there is sufficient room to permit the delivery of the fetus. A large passenger fills the bony pelvis so completely that it must be compressed and even molded before it can pass through the canal. The bladder, the urethra, and the rectum must also be considered because they must be displaced to permit the delivery of the child. At the pelvic outlet all the musculofascial structures bridging it must also be displaced (Fig. 2.). If they are displaced too rapidly, by a very fast delivery, lacerations may be expected. On the other hand, a delivery which is delayed compresses the blood supply to the pelvic organs and to the muscles of the pelvic outlet. The interference with the circulation alters the nutrition to the various structures and predisposes to a lessened elasticity. This change is similar to that taking place in a rubber band which is being stretched around an object larger than it can readily encompass. If the act is done too rapidly the band

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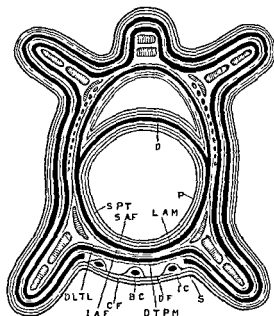


Fig 1 D Diaphragm, P peritoneum SPT superficial peritoneal layer SAF supra anal fascia LAM levator ani IAF infra anal fascia DTL deep layer triangular ligament DTPM deep transverse perineal muscle BC bulbocavernosus muscle IC ischio cavernosus muscle DF deep fascia CF Colles fascia S skin

will tear, while if it is cautiously stretched over the object it might withstand the strain. A band remaining around the object too long will never return to its original size. Due to poor elasticity of the soft parts, the elderly primipara and the subelastic parturient must be expected to have tears even though the delivery is well conducted. Such senile changes might be due to a hormonal deficiency which fails to bring about a softening and relaxation of the soft parts including the ligaments binding the bones of the pelvis.

Since a cystocele is usually present in the parturient woman who has stress incontinence it is desirable in addition to understand the mechanism of the formation of a cystocele. The injury causing the cystocele might if extended, involve involuntary and upper two voluntary sphincters of the urethra.

IMPORTANT ANATOMY

The normal urethra is about 4 centimeters in length and is composed of two layers of in-

voluntary muscular fibers. At its origin from the bladder, it is encircled by an additional hypertrophied layer of involuntary muscular fibers called the internal sphincter. Under basal conditions these structures retain urine within the bladder. Like the rectum the urethra must perforate the three muscular planes bounding the body cavity to communicate externally (Fig 1). Each muscular layer, instead of merely bridging the area bounded by the pubic arch is rearranged and concentrated about the urethra to act as three individual voluntary sphincters which contract when the intra abdominal pressure is increased and thereby prevent the extrusion of urine (Fig 2). The first muscular layer which is perforated by the urethra is the levator ani muscle. This muscle is the pelvic segment of the transversus abdominis muscle. The usual description of the levator does not show it completely surrounding the urethra but rather as two bundles of muscle which arise from the posterior surface of the pubic bone and run posteriorly lateral to the urethra to insert into the coccyx. As a matter of fact this description is incomplete because fibers are supplied to the urethra and at times surround its entire length with a layer of voluntary muscular fibers (Figs 3, 4, 5, 8). Between the urethra and the vagina the levator muscles are frequently connected by a transverse bundle of muscle (Fig 2, U1) while in other cases the muscular bundle is replaced by fibrous tissue. Nevertheless the general effect is to have a muscular structure similar in action to the digastric or omohyoid muscles in the neck which angulates the urethra anteriorly when both bundles contract simultaneously. Following the urethra distally the next muscular layer to be perforated is that comparable to the internal oblique layer of the abdominal wall (Fig 1). This muscular plane bridges the area bounded by the pubic arch and is called the deep transverse perineal muscle (Fig 7). Being a voluntary muscle it is covered on both surfaces by a layer of muscular fascia thereby forming the urogenital diaphragm or triangular ligament. This muscle in the male is vividly represented by drawings but four of our standard textbooks on anatomy fail to show

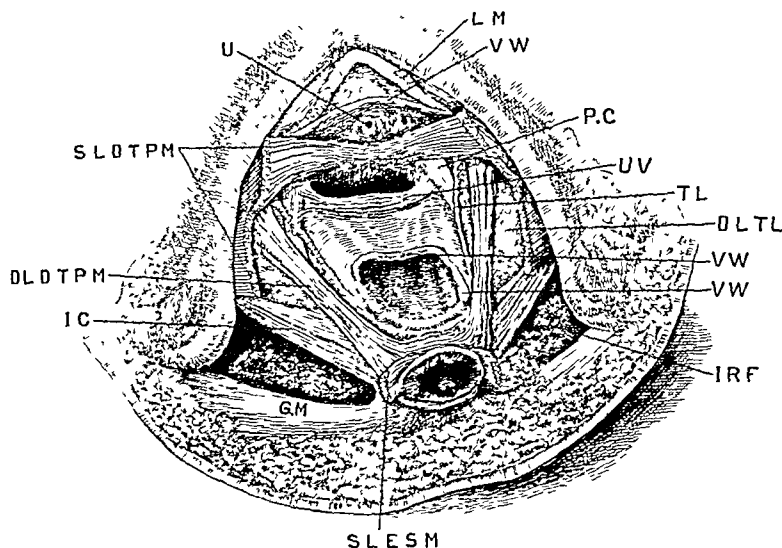


Fig 2 LM, Labia majora, VW, vaginal wall, U, urethra, DTPM, deep transverse perineal muscle, IC, ileococcygeus muscle, GM, gluteus maximus, PC, pubococcygeus, UV, urethrovaginal bundle of levator, TL, triangular ligament, cut edge, DLT L, deep layer triangular ligament, IRF, ischioanal fossa, SLES M, superficial layer external sphincter muscle

pictures of the muscle in the female. This fact is responsible for the extensive misconception in the minds of many gynecologists. To reiterate: the pubic arch is bridged by the deep transverse perineal muscle which is perforated by the urethra, the vagina, and the rectum. Its primary function is to act as a sphincter for those ducts which pass through it (Fig 2, DTPM). The last muscle layer perforated by the urethra is comparable to the external oblique muscle in the abdomen. This muscle, through use, no longer bridges the pubic arch as a distinct sheet, but has been differentiated into four distinct muscular groups with separate functions (Fig 6). The bulbocavernosus and the ischiocavernosus muscles are in close proximity to the urethra, but since they lie lateral to the urethra and communicate only anteriorly they are not usually described as sphincters of the urethra. As a matter of fact, they too, act like a digastric muscle and angulate the urethra posteriorly by simultaneous contraction. This kinking of the urethra is directly opposite to the angulation produced by the contracting levators (Fig. 7). The voluntary mechanism, in gen-

eral then, is a double angulation similar to the letter S (Fig 7). The proximal anterior kinking is due to the contracting levator muscles, the distal posterior kinking to the contracting bulbocavernosus muscles, while the deep transverse perineal muscle, which lies between the two, constricts the urethra circumferentially.

The inferior vesical artery and vein begin at the spine of the ischium and course anteriorly parallel to the arcus tendineus to the posterior surface of the pubic bone (Fig 8). Branches run medially and anastomose freely with those of the opposite side. They supply the base of the bladder. The bladder itself therefore lies anterior to this horizontal plane formed by the mesovesicæ of the inferior vesical vessels. The middle and superior vesical vessels are more tortuous and permit the distention of the filling bladder into the abdominal cavity, while the direct horizontal anastomosing character of the inferior vessels forms a shelf which does not permit the base of the bladder to bulge into the vagina. It might well be stated here that most of the blood supply to the vagina is derived from

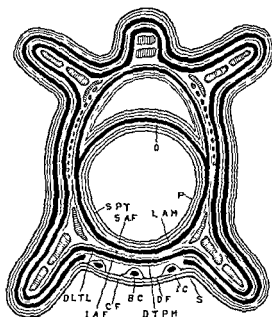


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IMPORTANT ANATOMY

The normal urethra is about 4 centimeters in length and is composed of two layers of in-

voluntary muscular fibers. At its origin from the bladder, it is encircled by an additional hypertrophied layer of involuntary muscular fibers called the internal sphincter. Under basal conditions these structures retain urine within the bladder. Like the rectum the urethra must perforate the three muscular planes bounding the body cavity to communicate externally (Fig 1). Each muscular layer, instead of merely bridging the area bounded by the pubic arch is rearranged and concentrated about the urethra to act as three individual voluntary sphincters which contract when the intra abdominal pressure is increased and thereby prevent the extrusion of urine (Fig 2). The first muscular layer which is perforated by the urethra is the levator ani muscle. This muscle is the pelvic segment of the transversus abdominis muscle. The usual description of the levator does not show it completely surrounding the urethra, but rather as two bundles of muscle which arise from the posterior surface of the pubic bone and run posteriorly, lateral to the urethra, to insert into the coccyx. As a matter of fact this description is incomplete because fibers are supplied to the urethra and at times surround its entire length with a layer of voluntary muscular fibers (Figs 3, 4, 5, 8). Between the urethra and the vagina the levator muscles are frequently connected by a transverse bundle of muscle (Fig 2 U 1) while in other cases the muscular bundle is replaced by fibrous tissue. Nevertheless the general effect is to have a muscular structure similar in action to the digastric or omohyoid muscles in the neck which angulates the urethra anteriorly when both bundles contract simultaneously. Following the urethra distally the next muscular layer to be perforated is that comparable to the internal oblique layer of the abdominal wall (Fig 1). This muscular plane bridges the area bounded by the pubic arch and is called the deep transverse perineal muscle (Fig 7). Being a voluntary muscle it is covered on both surfaces by a layer of muscular fascia thereby forming the urogenital diaphragm or triangular ligament. This muscle in the male is vividly represented by drawings but four of our standard textbooks on anatomy fail to show

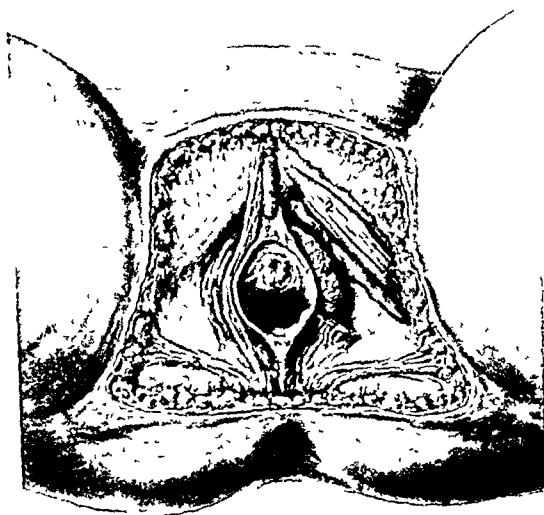


Fig 6 1, Bulbocavernosus muscle (clitoral fibers), 1A, bulbocavernosus (urethral fibers), 2, ischio-cavernosus, 3, superficial transverse perineal muscle, 4, bulb of vagina

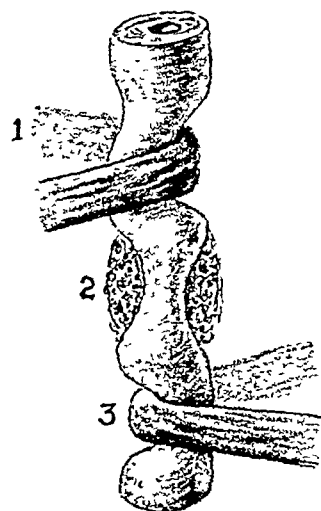


Fig 7 Diagrammatic urethral sphincters 1, Levator muscle, 2, deep transverse perineal muscle, 3, bulbocavernosus muscle

The next muscle to be damaged at the pelvic outlet is the deep transverse perineal muscle. It, too, is torn most frequently in the midline. The lateral portion of the muscle by being compressed against the border of the arch is relatively protected, while the medial portion which must be forced into the angle of the arch is damaged. A presenting part which remains at the outlet for two or more hours may compress the blood supply and predispose to further damage. This change is identical with the ischemia resulting in the forearm which has been compressed by a tourniquet in place for 2 hours or more.

As long as obstetricians are contented with a gaping vulva following childbirth, we must expect to have a diminished efficiency of the third voluntary sphincter. The bulbocavernosus muscles arise from the posterior perineal body and consequently a laceration diminishes the efficiency of these muscles.

TREATMENT

Patients seeking relief fall into two groups. In one group are those cases not due to childbirth and in the second group are those directly attributable to childbirth. The treatment of the former is directed toward develop-

ment of the muscles through calisthenics, horseback riding, and exercises of the levator as a whole. Married women might even be given careful instruction about the muscles of the pelvic outlet and also be encouraged to interrupt the urinary stream. The muscles surrounding the vagina should be intermittently contracted during the sex act and thereby develop the voluntary sphincters. Of course some time will be required before positive control is obtained, because of the ready fatigability of underdeveloped muscles. Urgency, due to venous stases, besides being treated by direct applications to the trigone, is greatly improved by the assumption of the knee chest posture. The abdominal muscles are then contracted in a wave-like manner beginning first in the region of the pelvis and ascending to the chest. This exercise improves the tone of the intestines, increases abdominal circulation, and diminishes pelvic congestion.

Surgical repairs in those cases in which there is damage from childbirth, which is limited to merely placing one or two sutures in an area which one assumes must contain the retracted sphincters, are only about 70 per cent successful. A more successful method is to follow a layer of tissue which is easily

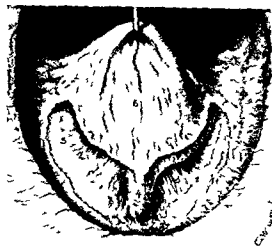


Fig. 3 1 peritoneal layer 2 supra-anal fascia 3 levator 4 urethra 5 arcus tendineus 6 bladder



Fig. 4 1 triangular ligament 2 deep transverse perineal muscle 3 levator fibers to urethra 4 rectovaginal ligament 5 mesovesica 6 uterine vessels

the inferior vesical artery as it courses along the arcus tendineus. The vessels run to the lateral border and form the mesovagina.

That portion of the mesovesica adjacent to the cervix is greatly thinned as the cervix dilates during the first stage of labor (Fig. 8). The second stage of labor with the passage

of the child through the pelvis, displaces the bladder and its mesovesica. Those patients having a wide pubic arch permit a rapid displacement of the anterior tissues and the mesovesica are often torn at the thinned cervical attachment. The tear may extend distally in the midline from the cervix to the urethra (Fig. 9) and if extended may involve the urethral sphincters in the midline. In other cases, a prolonged second stage of labor may cause steady pressure on the inferior vesical vessels and interfere with the nutrition of the bladder and its supporting structures. (Normally the intermittent descent and retraction of the presenting part favors the re-establishment of the circulation and protects the bladder from destructive circulatory changes.)

Besides a midline laceration of the mesovesica which may extend distally through the sphincters of the urethra, damage may be done to the voluntary sphincters as the head passes through the pubic arch. The levator being the deepest muscle is damaged first as the two pubococcygeal bundles are displaced laterally. The muscular bundle or the aponeurosis which connects them between the urethra and the vagina, like the belly of a digastric muscle, is torn or overstretched and consequently lessens the angulating action of the levators (Fig. 2).

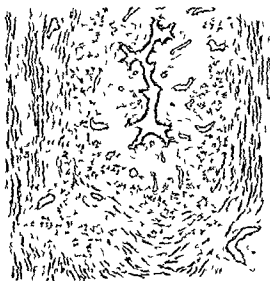


Fig. 5 Cross section female urethra 1 involuntary muscular layer longitudinal 2 involuntary muscular layer circular 3 voluntary muscular layer from levator

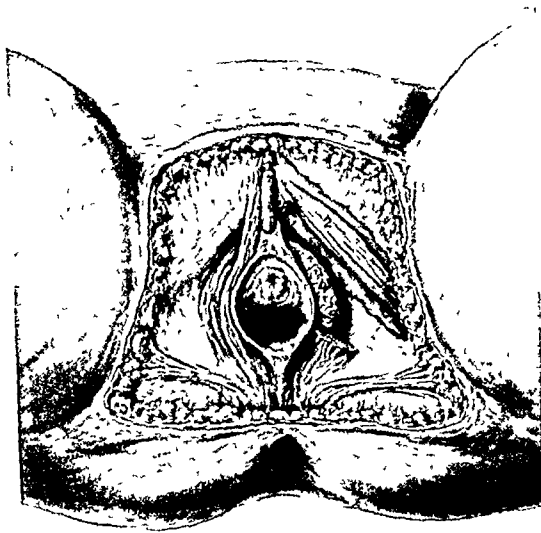


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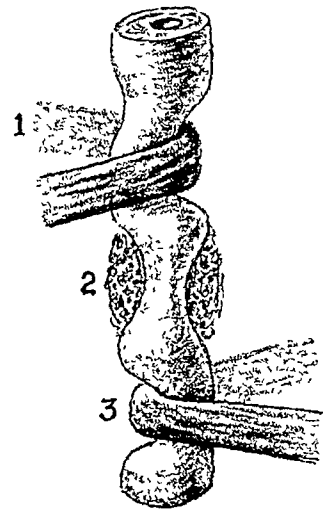


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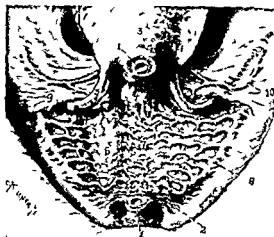


Fig 8 Bladder reflected to show anterior surface of vagina 1 bisected urethra 2 levator muscle surrounding urethra 3 bladder 4 cervix of uterus 5 ureter 6 anterior vaginal wall and mesovagina 7 mesovescicæ 8 inferior vesical artery 9 mesocervix 10 uterine artery

identified and leads to the structures to be repaired. The preliminary repair of a cystocele by reapproximating the retracted mesovesicæ of the base of the bladder (Fig 9) leads one accurately to the structures to be reconstructed, because all the layers fuse at body openings (Fig 8).

The vagina should be incised through its entire thickness, the mucous membrane and the musculofascial layer from the cervix to the external urinary meatus. The bladder should then be mobilized from the flaps of the vagina and from the uterus just as one



Fig 9 Showing laceration of the mesovesicæ on the base of the bladder which may extend into the muscularis.

does during a vaginal hysterectomy. By mobilizing the bladder from the vagina a roughened midline oozing area will be seen on the bladder, which represents the midline laceration of the mesovesicæ. Lateral to the roughened midline area, the smooth gray glistening retracted mesovesicæ can be seen (Fig 9). The usual repair of a cystocele in which the anterior wall of the vagina is either plicated or partly excised does not directly utilize the fibrous coat (mesovesicæ) on the base of the bladder. This structure is easily reapproximated because it is intimately attached to the muscularis of the bladder. The first suture is similar to the Alexandroff stitch which plicates the mesocervix anterior to the cervix. A series of interrupted sutures reapproximate the retracted mesovesicæ and invert the roughened area. As the bladder neck is approached the lacerated or relaxed involuntary urethral sphincter will thus be reconstructed. The use of a mushroom catheter will not be necessary as it must be withdrawn at the expense of accurately placed sutures in

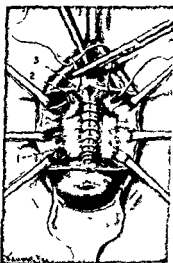


Fig 10 The mucous membrane and the fibromuscular coat of the vagina have been incised and mobilized to expose the base of the bladder 1 The retracted or relaxed mesovesicæ have been reapproximated in the midline. This tissue is intimately attached to the muscularis of the bladder and should be closed with superficial mattress sutures 2 levator fibers separated from the midline 3 membranous urethra

a friable structure (Fig. 10) Continuing distally, interrupted sutures will reattach the retracted levators *between the urethra and the vagina* More distally the deep transverse perineal muscle or membranous sphincter will be reattached in the newly reconstructed anterior perineal body The vagina should then be closed with interrupted sutures, two or three being placed in the urethral portion first while suitable exposure is available In the region of the middle third of the urethra the vagina should be anchored to the levator to restore the normal dimpling. In the region of the internal os of the cervix, the vagina should again be anchored to reconstruct the anterior vaginal fornix

The last urethral sphincter to be reconstructed is the bulbocavernous muscle (Fig. 6) The damage to this muscle is not in the region of the urethra, but posteriorly in the lacerated posterior perineal body which permits its retraction and as a result, a diminished efficiency The muscles must be reattached posterior to the vagina if their efficiency is to be increased As a rule the pelvic floor is repaired in all patients having plastic surgery but frequently the vulva gapes This means that the retracted bulbocavernous muscles have not been reapproximated This muscle, like the anal sphincter, retracts when torn and therefore the suture must be passed anteriorly lateral to the vagina to grasp the retracted muscular fibers which lie superficial to the erectile tissue in the labia minora When this suture is accurately placed, the labia minora will be drawn together and the patient will have a vulva which more closely resembles that possessed before labor.

After the three muscular sphincters of the urethra are reconstructed, the patient will probably have difficulty in voiding This is due to the fact that the reconstructed muscles must be re-educated to relax, since this function has deteriorated during the time intervening between labor and the subsequent repair of the lacerations

The author has treated 50 cases surgically since 1930 They have been followed regularly and have been classified by several men on the staff after the patients were asked specifically whether they lost urine by coughing,

laughing, straining, or working There were 5 uncorrected failures, an incident of 90 per cent successfully treated. Of the 5 failures two were again operated upon by another surgeon who also removed myomatous uteri It is possible that the myomatous uterus and not the plastic technique was responsible for the failure in 2 cases A corrected percentage of successful cases is hardly necessary due to the great improvement over previous techniques

CONCLUSIONS

- 1 The female urethra is approximately 4 centimeters in length
- 2 Two layers of involuntary muscle surround its entire length
- 3 At its bladder attachment the urethra is encompassed by an additional layer of involuntary muscle called the sphincter of the vesical neck
- 4 Under resting conditions the involuntary muscles maintain a tonicity about the urethra sufficient to maintain urine within the bladder
- 5 Increased intra-abdominal pressure requires a voluntary sphincter about the urethra which contracts synergistically with the muscles causing increased intra-abdominal pressure
- 6 The voluntary muscles correspond to the three muscular layers of the abdominal wall
- 7 The deepest voluntary sphincter is derived from the levator and angulates the urethra postero-anteriorly At times the levator supplies a voluntary coat to the entire length of the urethra
- 8 The intermediate voluntary sphincter lies between the layers of the urogenital diaphragm and is called the deep transverse perineal muscle
- 9 The superficial voluntary sphincter is due to the simultaneous contraction of the bulbocavernous muscles which lie lateral to the vagina and communicate anterior to the urethra
- 10 The involuntary sphincters are usually damaged while the head is in the midpelvis, and the damage is due to the displacement of the bladder with concomitant lacerations in the midline.

11 The voluntary sphincters are usually damaged at the pelvic outlet

12 Two anatomical damages are possible the one being due to prolonged overstretching brought about by a long labor, the other due to a midline laceration which may extend from the cervical attachment of the bladder to the external urinary meatus

13 Patients with stress incontinence who have no gross anatomical damages should be trained to develop the voluntary muscles of the urethra

14 In those having anatomical damage accurate reconstruction can be accomplished by first reapproximating the lacerated tissue on the base of the bladder, which repair when continued distally will reconstruct the involuntary sphincter at the neck of the bladder

and eventually, the levator and the deep transverse perineal muscles

15 The superficial sphincter is reconstructed as the posterior perineal body is repaired

16 In a series of 50 cases of stress incontinence since 1930, surgical treatment resulted in cures in all but 5 cases or a successful outcome in 90 per cent

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CLINICAL AND RADIOLOGICAL DATA ASSOCIATED WITH CONGENITAL AND ACQUIRED SINGLE KIDNEY

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WITH the widespread use of excretory urography as a routine method in abdominal diagnosis, failure of visualization of one kidney is rather frequently observed. This often happens when there are few if any symptoms referable to the affected kidney. We have learned from experience that failure of visualization does not necessarily mean that the kidney is absent or destroyed. It is surprising how very little obstruction will reduce the positive intrarenal pressure sufficiently to prevent the excretion of opaque substances. It is remarkable how long such incomplete obstruction can exist without causing permanent renal damage. We have observed cases in which this has persisted for months and when the obstruction is removed renal function returns to normal.

However, it is not our present purpose to continue with this fascinating problem of renal function but to consider the problem of clinical interpretation and failure of renal visualization in the excretory urogram. Temporary obstruction can usually be inferred from the presence of shadows of stones in the renal or ureteral areas, by a persistent, enlarged renal shadow on the affected side, and by cystoscopic data. When this has been excluded and no evidence of the kidney or ureter is present in the urogram, one must necessarily suspect the existence of renal agenesis or failure of renal development. It is true that absence of any clinical data suggestive of the presence of a kidney does not necessarily indicate agenesis. Other than congenital pathological conditions there are various pathological lesions which may cause renal atrophy or destruction and which often leave remnants of renal tissue so insignificant

that their recognition would be possible only on careful postmortem examination. Nevertheless, with adequate roentgenological and cystoscopic data, the evidence of renal agenesis is sufficient to recognize the condition in many instances. Careful surgical exploration will, of course, give additional evidence of the lesion. Briefly, therefore, having excluded temporary renal obstruction, evidence of renal absence in the roentgenogram may indicate either previous surgical removal, renal destruction resulting from disease, or congenital absence. The remaining kidney may then be regarded as being either a congenital or acquired solitary kidney.

Let us consider the data which are made available by the roentgenogram in the recognition of renal agenesis. It should be remembered that the renal outline is not always clearly defined in the roentgenogram and may be easily confused with that of adjacent organs and tissues. Likewise, the outline of adjacent tissues may simulate that of the kidney. On many occasions we have observed what was apparently a typical renal shadow in cases in which the kidney had been removed or was absent. It is often difficult to determine the exact outline or limits of the kidney, as the result of overlying intestinal shadows. What is apparently an enlarged or irregular kidney may in subsequent roentgenograms prove to be rather normal in size or contour. Nevertheless, recognizing the possibility of error, a careful examination of the renal outline is often of much value, not alone in the recognition of absence of a kidney, but also in the diagnosis of various pathological kidney conditions. However, if agenesis is present, the original roentgenogram will usually reveal the absence of the renal outline on one side. The renal outline on the opposite side then becomes of considerable diagnostic importance. If the kidney is greatly hypertrophied, it may

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be inferred that the other kidney is functionless. If the renal outline is normal it usually means that the invisible kidney either has some function remaining or that it has only recently become functionless. It will be noted that the increase in size, particularly with acquired solitary kidney, may be so little that it resembles a large normal kidney.

CLINICAL DATA ASSOCIATED WITH RENAL AGENESIA

A series of 27 cases of proved renal agenesis has been observed at the Mayo Clinic from 1909 to the present time. The diagnosis was established at operation in 14 cases and at necropsy in 13 cases. In 42 cases the diagnosis was inferred from roentgenographic and cystoscopic data, making a total of 69 cases. The incidence in regard to sex was about equal, since the condition occurred in the male in 38 cases and in the female in 31 cases. The kidney was absent on the right side in 32 cases and on the left in 37 cases. The average age of the patients was 38½ years, the oldest patient was 66 years of age, and the youngest was 2½ years of age.

DIAGNOSIS OF RENAL AGENESIA

Since we began the use of excretory urography as a diagnostic agent in 1930 the diagnosis of renal agenesis has been made by clinical methods in 20 cases. During the past year 8 cases were observed in the course of roentgenographic and cystoscopic studies. In 5 of the 29 cases the diagnosis was confirmed by operation and in 3 cases by necropsy.

Symptoms. The most common subjective symptom was pain on the side of the remaining kidney which occurred in 38 of the 69 cases. The pain was usually dull in character although in 8 cases it was rather severe. When the patient complained of pain in the side of the present kidney the kidney was more often palpable and tender than when the patient was symptom free. Pain was referred to the back, flanks or abdomen in 6 cases. In 2 cases the pain was referred to the side of the absent kidney; the cause of this was not clear. Twenty three of the 69 patients had no subjective symptoms referable to the kidneys or bladder.

Physical examination. Findings at physical examination were reported negative in 46 or 66 per cent, of the 69 cases. Of the 23 cases in which there were positive physical data, the presence of a palpable mass in the flank on the side of the present kidney was the most common finding, it occurred in 17, or 74 per cent of the total number of cases. The next most common finding was tenderness on palpation on the side of the present kidney; this occurred in 11, or 16 per cent, of the cases. Both mass and tenderness together on the side of the kidney present occurred in 5 cases, or about 8 per cent.

Secondary complications. As one of us (Braasch) pointed out in 1912, renal anomaly is prone to secondary complications. Secondary complications occurred in the remaining kidney in 43 cases of renal agenesis. The most frequent complication was pyelonephritis or a definite history of previous pyelonephritis. Evidence of active pyelonephritis was found on urologic examination in 17 cases. The most common organism present was *Escherichia coli*, which was found in 6 cases. In 4 cases the organism was indeterminate. A history of pyelonephritis was given by 6 patients but at the time of urologic examination no active infection was found. Active pyelonephritis or a history of previous pyelonephritis was present in 23 cases, or 33 per cent of the total number. Anomaly of the kidney present, which was next in order of frequency, occurred in 7 cases or 10 per cent and was usually characterized by renal ectopia and failure of rotation. Hydronephrosis occurred in 6 cases or 8 per cent. Tuberculosis in the single kidney was present in 2 cases. Stones were present in the renal pelvis in 3 cases and ureterolithiasis was present in 3 cases. Glomerulonephritis occurred in 3 cases, focal nephritis in 1 and an infarct of the kidney was found present in 1 case at necropsy. Diverticulum of the bladder occurred in 1 case in which the patient was a female.

Cystoscopic data. Cystoscopic observation of the trigone will often reveal data suggestive of renal agenesis. Hypertrophy of the interureteral ridge on the side of the kidney is usually well defined and there is complete absence of the ridge on the other side. Com-



Fig 1 Right agenesis, enlarged renal outline, shadow of psoas muscle is slightly less sharp on the right side



Fig 2 Right agenesis, psoas muscle less sharply defined

compensatory hypertrophy of the ureteral orifice is usually evident, and urinary expulsion is usually more energetic and frequent. It is of interest that the reflex inhibition of excretion as the result of ureteric or vesical spasm frequently caused by the cystoscope is seldom observed in cases of single kidney. This is particularly true in cases of agenesis.

Roentgenographic data associated with congenital and acquired single kidney. Varying statements have been made concerning the size of the kidney in cases of renal agenesis and the relative size of the renal outline and the size of the pelvis in the roentgenogram. An attempt was made to form some definite conclusion concerning this relationship, as well as to obtain other data from a study of roentgenograms made in this series of cases of congenital solitary kidney. The roentgenograms and urograms were found suitable for roentgenologic investigation in 36 of the 69 cases.

The size and position of the kidney, the size of the renal pelvis, and the width and definition of the psoas muscle were noted. These data were compared with similar observations made from the roentgenograms in 33 cases of

acquired solitary kidney and also with a series of 100 consecutive excretory urograms which were made recently.

Size of the renal outline in renal agenesis. Measurements of the renal outline were made directly on the roentgenogram, in the long axis, and at the point of greatest width of the kidney. The average dimensions of all the kidneys were 15.2 centimeters long by 7.8 centimeters wide. The average size of normal kidneys was 12 by 6 centimeters. The longest kidney, which was 19 centimeters long, occurred in a male and the widest, which was 10 centimeters, occurred in a female, the former was 19 by 8 centimeters, and the latter was 14.5 by 10.0 centimeters. The smallest kidney, which was 12.0 centimeters in length, occurred in a female and the narrowest, which was 5.5 centimeters, also occurred in a female, the complete measurements of the former were 12.0 by 6.5 centimeters, and those of the latter were 15.0 by 5.5 centimeters. In 24 cases the average size of the male kidney was 15.7 by 8.1 centimeters and that of the female kidney was 14.8 by 7.1 centimeters. Thus, the long axis of the kidney in the male averaged 0.9 centimeter more than it did in the female,

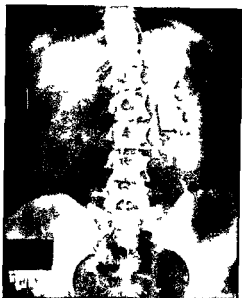


Fig 3 Urogram made 6 years after removal of right kidney psoas muscle less sharply defined

and the width in the male was 1.0 centimeter greater than it was in the female. This greater size of the male kidney held true proportionally among normal persons. In grading the size of the renal outline on a basis of 1 to 4, 3 kidneys were graded normal, 5 were grade 1, 15 were grade 2, 11 were grade 3 and 1 was grade 4. Such gradation is necessarily relative, since variations in size of the kidney occur with the size of the individual. In 8 of 9 cases in which the kidney was explored, the kidney was described as being enlarged but the enlargement was not graded definitely. Of 10 postmortem specimens of renal agenesis 9 were found enlarged, the degree of enlargement was graded approximately as in the roentgenologic measurements. It may be inferred, therefore, that the congenital solitary kidney is enlarged in fully 90 per cent of cases (Figs. 1 and 2).

Size of the renal pelvis in renal agenesis. The size of the renal pelvis was graded in 33 cases. The renal pelvis was normal in size in 16 cases and enlarged in 14 cases. In 5 cases the enlargement was grade 1, in 8 cases it was grade 2, in 1 case it was grade 3 but in no case was it grade 4. Hydronephrosis of undetermined

cause was present in 1 case and moderate pyelectasis due to ureteral stone occurred in 2 cases. On comparing the degree of enlargement of the renal outline with the enlargement of the renal pelvis, it is evident that the pelvis was of normal size in 53 per cent of cases, grade 1 hypertrophy occurred in 16 per cent, and grade 2 occurred in 26 per cent of cases, as compared with enlargement of the renal outline in 90 per cent of the cases in 72 per cent of which the enlargement was grade 1 and grade 3. It is of interest, therefore, that the degree of pelvic enlargement is not commensurate with that of the renal parenchyma. It is also of interest that the visualization of the renal pelvis in the intravenous urogram is in most cases better than in the normal kidney. It was also noted that the visualization was earlier and persisted a shorter time after injection than with the average kidney.

SIZE OF THE RENAL OUTLINE FOLLOWING NEPHRECTOMY

Measurements of the acquired solitary kidney were made on roentgenograms taken in 31 cases observed during the last 6 months. The average renal outline measured 14.7 by 7.1 centimeters. In the 8 cases in which the patients were females the average size was 14.6 by 6.6 centimeters. In the 23 cases in which the patients were males the average size was 14.7 by 7.2 centimeters. Thus, the chief difference between male and female patients in this group was in the width of the renal outline. The largest kidneys, which measured 17.5 by 6.0 centimeters and 16.5 by 8.0 centimeters, occurred among males, the smallest kidneys which measured 12.5 by 6.0 centimeters were found in 2 females. In grading the size of the renal outline in these cases on the basis of 1 to 4 the kidney was regarded as normal in 8 cases, for an average period of 2 years following nephrectomy. It was hypertrophied grade 1 in 10 cases, but the postoperative course was less than 1 year in 1 case. In 15 cases the hypertrophy was grade 2 the postoperative period averaged 3 years in these cases but in 5 cases it was more than 9 years. In no case was the grade of hypertrophy regarded as being 3 or 4. Thus the roentgenographic outline of the acquired

single kidney was graded as normal or grade 1 in 55 per cent of the cases, as compared with about 20 per cent in cases of renal agenesis. In other words, the degree of hypertrophy of the acquired single kidney is distinctly less than in cases of renal agenesis. It would also appear that the increase in size of the acquired solitary kidney continues in some cases for 2 or 3 years. In some cases observed, however, the kidney attained its full size within a few months after removal of the other kidney. These findings would negate the opinion held by some surgeons that, if a kidney explored is normal and not hypertrophied, there must be a functioning kidney on the other side.

SIZE OF THE RENAL PELVIS FOLLOWING NEPHRECTOMY

The size of the renal pelvis following nephrectomy was estimated in the same group of 33 cases in which the renal outlines were measured. In 15 cases the pelvis was of normal size, in 6 cases the hypertrophy was grade 1, and in 11 cases it was grade 2. In no case was the hypertrophy grade 3 or 4. A comparison of the renal pelvis in renal agenesis with that of the acquired single kidney reveals little difference (Fig. 3).

THE POSITION OF THE KIDNEY IN RENAL AGENESIS AND AFTER NEPHRECTOMY

The position of the renal outline in cases of congenital single kidney was normal or slightly low in 22 cases (in 1 case it was close to the spinal column). Definite renal ptosis was noted in 8 cases, in 4 of which the kidney was in the sacral region and in the midline. The renal outline was situated higher than the average in 6 cases (in 1 case it was close to the spinal column). The position of the acquired solitary kidney was usually much higher. It was described as normal in 16 cases, high in 16 cases, and low in 1 case. It is evident that the congenitally solitary kidney tends to occupy a position lower than that taken by the hypertrophied compensatory kidney after nephrectomy. It may be said to be characteristic for the kidney of renal agenesis to occupy a much lower position than normal and this sign may be regarded as a definite factor in identifying this condition.

THE PSOAS SHADOW IN RENAL AGENESIS

The study of the outline of the psoas shadow in renal agenesis was initiated by the observation of an unusually wide outline of the psoas muscle on the side of the absent kidney in a recent case. On reviewing the roentgenograms made in 36 cases of agenesis it was noted that in 6 cases, or about 16 per cent, the psoas shadow was wider on the affected side. A far more common finding, however, was the occurrence of less sharp definition of the psoas shadow on the side of the absent kidney. This difference in definition of the psoas shadow occurred in 40 per cent of the cases. Of interest is the fact that in 73 per cent of cases in which the outline of the psoas muscle was less sharply defined the kidney on the right side was absent. There is apparently no anatomical reason for this right sided preponderance, although it is possible that the absence of the kidney may allow closer approximation of the outer border of the psoas muscle and the adjacent lumbar structures. This would permit a lateral shift in the position of the descending portion of the duodenum and thus obscure the margin of the psoas muscle. Better definition of the outline of the psoas muscle occurred in 2 cases of left renal agenesis. The psoas shadows were of equal definition in 12, or one-third of the 36 cases. The cause for reduced definition of the psoas muscle may be ascribed to atrophy. It would seem probable that some relation in innervation or lymphatic supply exists between the absent kidney and the psoas muscle.

THE PSOAS SHADOW IN 100 CONSECUTIVE EXCRETORY UROGRAMS

On reviewing 100 consecutive excretory urograms which were made recently it was found that the psoas shadows were of equal width in 99 of the 100 cases, as compared with equality of width in less than half the cases of renal agenesis. In only 1 of the 100 urograms interpreted as normal was the right psoas shadow wider than the left. Definition of the psoas shadow was equally good on both sides in 84 of the 100 urograms. It was less sharply defined on one side in 13 cases, the outline of the right psoas muscle was less sharply defined in 9 cases, and the outline of

the left psoas muscle was less sharply defined in 4 cases. It, therefore, is evident that changes in the outline of the psoas muscle occur less often in an unselected series of urograms than they do in urograms in cases of renal agenesis.

SUMMARY

Renal agenesis is associated with certain clinical data which usually identify it. Most important are the following roentgenographic data. In renal agenesis the renal outline is larger than the outline of an acquired single kidney or a normal kidney. The incidence of hypertrophy not only is twice as great in renal agenesis as it is in an acquired single kidney but the degree of hypertrophy is also greater. The relative increase in size of the renal pelvis does not equal that of the parenchyma in most

cases, although an increase in size is frequently observed. Little difference in the size of the renal pelvis exists in congenital or acquired single kidney. The renal outline is generally situated lower in renal agenesis than in acquired single kidney or a normal kidney. This may be regarded as a definite factor in differential diagnosis. The outline of the psoas muscle is less sharply defined on the side of the absent kidney in cases of congenital and acquired single kidney than it is in an unselected series of urograms. There is an increase in the width of the psoas muscle on the side of the absent kidney in a few cases of agenesis.

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AN INVESTIGATION OF THE SURGICAL ANATOMY OF THE LIGAMENTS OF THE KNEE JOINT

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THERE has been a definite trend in the recent literature of knee joint surgery suggesting the prime importance of the collateral ligaments and the secondary significance of the crucial ligaments in the stability and function of the knee joint

It has often been noted that uncomplicated cases of complete dislocation of the knee joint, properly immobilized and conservatively treated, often result in knees with normal stability, despite evident rupture of the ligamentous structures (3). Some authors have observed that a torn cruciate ligament may be disregarded, or a fractured tibial spine and its attached anterior crucial ligament extirpated, without disturbing the integrity of the knee joint (6). In addition, several observers have recently advocated repair of the collateral ligaments alone and disregard of associated crucial ligament tears, supporting their contentions with convincing clinical results (1, 6, 8, 9)

Such beliefs are not substantiated by most anatomists, who stress the importance of the cruciate ligaments to the mechanics of the

From the Daniel Baugh Institute of Anatomy of the Jefferson Medical College of Philadelphia, Director, Professor J Parsons Schaeffer

knee joint The work of a few, as the Webers and Testut, suggests an anatomical basis for these clinical observations

An attempt to readjust anatomical facts in accordance with the clinical experience of these other authors is herein made, following a study of twenty knee joint specimens at the Daniel Baugh Institute of Anatomy

MOVEMENTS OF THE KNEE JOINT

The condylar surfaces of the femur revolve following a spiral curve, the radii of which diminish from before backward The radii of curvature of the external femoral condyle diminish more rapidly in length than those of the internal condyle This form of the sagittal curvature of the femoral condyle has been studied by the Webers, Fick, Bugnion, and others The Webers found the radii of the internal condylar curvature to diminish from 53 millimeters at the onset to 17 millimeters at the end, from before backward Bugnion found considerable variation in these measurements in five subjects, of 33.5 to 40 millimeters for the longest radii to 15.5 to 17 millimeters for the shortest, these radii being determined at a distance of 1 centimeter from

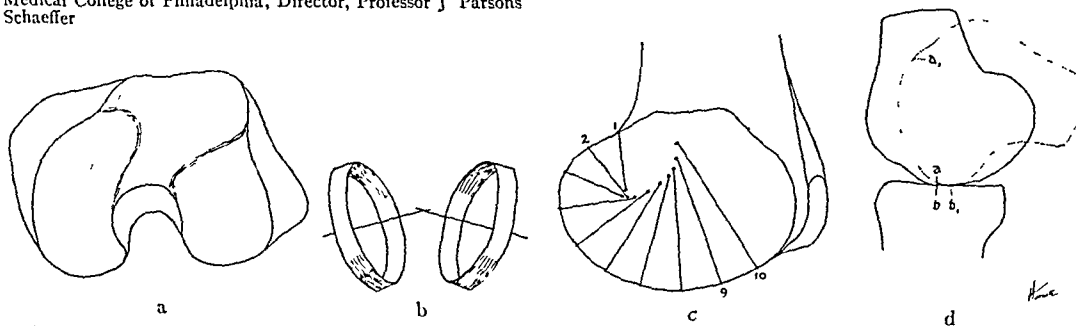


Fig 1 a, Inferior extremity of the femur viewed from below and, b, schematic representation of the femoral condyles viewed posteriorly, showing the divergence of these condylar surfaces posteriorly, and the obliquity of their transverse axes c, Sagittal section of the internal femoral condyle through the dotted line in a, showing the

diminishing radii of curvature of the spiral surface and the formation of the evolute d, Sagittal section of the knee joint in extension and flexion The discrepancy which is illustrated in the distances between a and a', and b and b' is explained by the gliding mechanism of the knee joint (After Testut)

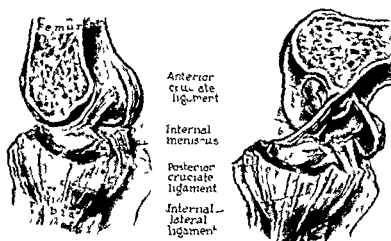


Fig. 2 The internal femoral condyle has been removed to demonstrate the anterior cruciate ligament in extension and in flexion.

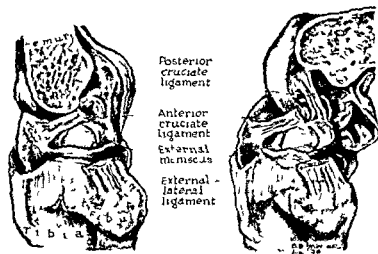


Fig. 3 The external femoral condyle has been removed to demonstrate the posterior cruciate ligament in extension and in flexion.

each other. Such a curve is therefore not described about one center of motion, but the centers of motion are constantly changing and form a line called the *scalute* (Fig. 1 c).

Motion of flexion and extension is a combination of (1) rocking or hinge motion and (2) gliding motion which largely supplants the former after the knee has flexed 15 to 20 degrees from full extension. This gliding

mechanism is illustrated in Figure 1 d. (3) The terminal phase of extension is associated with internal rotation of the femur which locks the knee in terminal extension while in the termination of acute flexion external rotation is evident. Both motions are about a vertical axis which lies nearer the internal femoral condyle. (4) A fourth motion may be observed, a forward pulsion of the tibial head

as the knee is flexed from about 120 degrees of flexion (60 degrees from full extension) to right angle flexion. Such motion is influenced not only by the rapidly diminishing radii of curvature of the condyles, but also because the femoral condyles diverge from before backward so that the transverse diameter of the inferior extremity of the femur is greatest posteriorly (Fig. 1, a and b).

THE LIGAMENTS OF THE KNEE JOINT

The knee joint is reinforced by a number of tendons and muscle bellies which are of prime importance to the *extrinsic* stability of the joint but play no part in its *intrinsic* support, i.e., the limitation of the lateral, anteroposterior and rotatory motions. As noted by the Webers, the severance of all of these tendons as well as the capsule and posterior oblique ligaments, in a bared specimen, nowise disturbs the integrity and stability of the knee joint provided the collateral and cruciate ligaments are preserved.

The *tibial collateral* (internal lateral) ligament is broad and flat and passes from the femur to the tibia obliquely from above downward and forward. Its superficial fibers are long, its deep fibers short and intimately attached to the internal meniscus.

The *fibular collateral* (external lateral) ligament is round and cord-like, passing from the lateral femoral epicondyle obliquely downward and backward to the fibular head, in front of its highest point, and splitting the biceps tendon.

Both *cruciate ligaments* traverse the joint obliquely in both sagittal and frontal planes. Some anatomists, notably Luschka, believe that they serve to divide the knee joint into separate articulations of which the external ligaments are represented by the collateral ligaments.

The anterior runs from the rough area in front of the intercondylar tibial eminence to the medial side of the lateral femoral condyle, while posteromedial to it lies the posterior cruciate ligament which is directed upward, forward, and inward from behind the tibial eminence to the lateral side of the medial femoral condyle. Both insert into the femur in a broad, fan-like fashion, and consist of a

thick anterior and thin posterior portion (Figs 2 and 3).

In an attempt to determine the function and to evaluate the relative importance of these four ligaments, the following studies were pursued:

A. COLLATERAL LIGAMENTS INTACT CRUCIATE LIGAMENTS AND ALL OTHER STRUCTURES OF BARED SPECIMEN SEVERED

1 Both lateral ligaments are taut at full extension (180 degrees), but, with flexion, the external ligament and the posterior part of the internal collateral ligament relax as their tibial and femoral attachments approximate, due to the diminishing radii of curvature of the femoral condyles from before backward. The anterior portion of the internal lateral ligament remains tense even in flexion but does not inhibit this motion.

2. There is no lateral motion in complete extension. Maximum lateral motion is present at 145 to 135 degrees flexion (35 to 45 degrees from full extension) and diminishes thereafter until it is again absent at right angle flexion, due to the fact that the femoral condyles diverge most and are widest posteriorly and completely occupy the tibial plateau.

3 The lateral ligaments prevent excessive external rotation of the tibia on the femur by their obliquity, and check undue internal rotation of the tibia after severance of the cruciate ligaments. Maximum forced rotation of the tibia on the femur is present at right angle flexion with the lateral ligaments relaxed, through an arc of about 60 degrees, 15 degrees of internal and 45 degrees of external rotation.

4 No distraction of the tibia from the femur is possible in complete extension or at right angle flexion (90 degrees), and becomes only slightly evident when the collateral ligaments are relaxed at 145 to 135 degrees of flexion (35 to 45 degrees from full extension).

5 No anteroposterior motion of the tibia on the femur is present in full extension, but this motion becomes evident with flexion, reaching its maximum (about 3 to 4 millimeters) at 135 degrees of flexion and diminishing thereafter. It is completely eliminated by externally rotating the tibia, which further

tenses the lateral ligaments, and is exaggerated by internal rotation of the tibia. Note that, as in (1), the anterior portion of the internal collateral ligament remains taut in flexion and effectively assists the limitation of anteroposterior motion despite the absence of the cruciate ligaments.

B CRUCIATE LIGAMENTS INTACT

LATERAL LIGAMENTS AND ALL OTHER STRUCTURES OF BARED SPECIMEN SEVERED

1 Hyperextension is possible to approximately 20 degrees beyond the normal placing the posterior cruciate ligament on tension. Further forced tension tears the ligament from its femoral attachment.

2 At full extension (180 degrees) definite lateral motion exists which increases with flexion until it becomes most marked at 145 to 135 degrees of flexion (35 to 45 degrees from full extension). It diminishes thereafter and is absent at 90 degrees of flexion since the femoral condyles are broadest and diverge most posteriorly, and in this stage of flexion completely occupy the tibial plateau.

3 External rotation of the tibia is unrestricted through an arc over 180 degrees as the cruciate ligaments 'untwine,' but internal rotation is limited by the abutment of the anterior (lateral) against the posterior (medial) cruciate and this limitation increases with flexion as these ligaments grow more tense, is about 15 degrees with the knee flexed at a right angle.

4 In full extension there is slight anteroposterior motion and slight distraction of the tibia from the femur. Both movements are exaggerated by flexion with maximum distraction (about 3 to 4 millimeters), and anteroposterior motion (about 6 to 8 millimeters) present at 135 degrees of flexion (45 degrees from full extension) and with the tibia slightly externally rotated. These movements diminish thereafter until absent at right angle flexion, and are also eliminated by internal rotation of the tibia which further tenses the cruciate ligaments.

5 The anterior cruciate pursues a course identical with that of the internal lateral ligament and posterior with that of external lateral ligament. Each pair tenses simultaneously.

C FEMUR SPLIT IN SAGITTAL PLANE

1 *Posterior cruciate ligament* As the knee joint is flexed, the femoral attachment of this ligament travels upward and forward, with increasing tension of its thickened anterior portion. The thinner posterior portion is not as tense and becomes relatively taut only in full extension with tibia internally rotated.

Two fixed points were selected at the tibial and femoral attachments of this ligament and the distance between them measured in varying degrees of flexion. As shown, these points become distracted with increasing flexion, evidencing increasing tension of the posterior cruciate ligament, and tend to approximate only when the knee is acutely flexed.

Angle of flex Degrees	Specimen	
	I	II
	mm	mm
180°	15	17
165	17	18
150	18	19
135	19	20
90	20	21
60	23	19
45	21	18

Full extension

2 *Anterior cruciate ligament* This ligament consists of a thick antero internal and a thin postero external portion. It was noted that the main anterior portion was taut in flexion and relaxed in extension, the posterior portion was moderately taut in extension, and entire ligament became tensed with internal rotation of tibia. Two fixed points were selected at the tibial and femoral attachments of the anterior portion and distance between them measured with knee in varying degrees of flexion.

Angle of flexion Degrees	Specimen				
	I	II	III	IV	V
	mm	mm	mm	mm	mm
180°	28	28	28	26	26
165	29	29	29	27	26
150	30	30	30	28	27
135	30	30	30	30	28
120	31	31	31 5	31	30
90	30	30	31 5	29	29
75	29	28	30	28	28
60	27	27	29	27	28
45	27	27	27	25	27

F II EAST DAHOM

The maximum distraction, and therefore the greatest tension of the main anterior portion, is in flexion of the knee at 120 to 90 degrees. Note that with flexion beyond a right angle the ends of the ligament approximate even closer than in full extension, since terminal external rotation of the femur in acute flexion serves further to relax the anterior cruciate ligament.

OBSERVATION MADE IN STUDIES ON UNBARED SPECIMENS

In several unbared knee joint specimens the ligaments were severed with a tenotome, through small incisions in the skin and capsule, and these wounds were then closed tightly. The following observations confirm the studies which have been reported by the Webers and Hyrtl.

1. With one and then both cruciate ligaments severed, lateral stability remains undisturbed from the normal. External rotation of the tibia is normal and internal rotation, absent in extension, becomes increased by flexion of the knee and reaches a maximum at right angle flexion. Very slight anteroposterior motion is evident only in flexion, and is most marked at 135 degrees of flexion (45 degrees from full extension) and with the tibia internally rotated. This amount of motion is far less than that noted in the bared specimens. This anteroposterior motion is eliminated when the tibia is externally rotated and the collateral ligaments are therefore tensed.

2. With the internal collateral ligament severed and the cruciate ligaments intact, lateral instability, i.e., abduction of the tibia on the femur, becomes evident in extension and is exaggerated on flexion. Internal rotation is intact but external rotation of the tibia is markedly increased. Anteroposterior motion is definitely present in complete extension and partial flexion, and this lessens with flexion until it is no longer evident with the knee flexed at right angles. Severance of the external lateral ligament exaggerates the anteroposterior, the lateral, and the rotatory instability; permission of undue adduction of the tibia on the femur is thus brought about.

EVALUATION OF STUDY

The lateral ligaments are the most essential structures in preserving the *intrinsic* stability of the extended knee, converting it into a perfectly rigid support. They prevent lateral instability, inhibit excessive external rotation of the tibia, and check undue internal rotation as efficiently as the cruciate ligaments, in the latter's absence. The internal collateral ligament, especially through its anterior portion which remains tense even in flexion, efficiently checks undue anteroposterior motion and distraction of the tibia from the femur in flexion, in the absence of the cruciates, motions which are impossible in full extension when both collaterals are most tensed.

The action of the cruciate ligaments is shown to be either accessory, or prominent only during the flexion phase of knee joint motion and not indispensable to the stability of the knee joint, especially during its weight bearing function. It is interesting to note that some students of comparative anatomy have stressed the superior development of the cruciate ligaments, as compared to man, in lower vertebrates in whom the knees are constantly flexed in weight bearing.

That the anterior cruciate, as well as the posterior, tenses especially in flexion and only partially in extension is contrary to the teachings of most anatomists. This action of the cruciates was only inferred by the Webers, but is substantiated by Testut: "The anterior cruciate ligament is stretched in flexion; the posterior, somewhat stretched in extension, is again stretched in flexion. The two ligaments are chiefly for the limitation of rotation" (internal rotation of the tibia).

Honigschmeid produced crucial ligament tears by hyperextension of the tibia on the femur and by hyperflexion of the knee over a wedge. Pagenstecher experimentally injured the cruciates by direct violence applied in front and behind the tibial upper extremity. In my own hands such measures resulted in complicating fractures of adjacent osseous structures, and I was most successful in traumatizing and tearing these ligaments as Pringle did, that is, by fixing the pelvis, flexing the hip and knee, and hyperabducting

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45	26	27	27	25	27

Full extension

THE BEHAVIOR OF THE HEMOGLOBIN AFTER BLOOD TRANSFUSION

WILLIAM L. SIBLEY, M D, and JOHN S. LUNDY, M D, Rochester, Minnesota

THE question which instigated this work was whether the benefits to be derived from blood transfusion were lessened when a reaction to transfusion occurred. It has been said by many that a reaction to transfusion is an undesirable effect, but no reason for this assumption has been given. Others have said that they thought reactions in certain cases were definitely beneficial clinically. In this work, observations also concerned the following: (1) the behavior of the hemoglobin in the general run of cases after transfusion; (2) the relation of the value for donor's hemoglobin to the amount of increase in value for recipient's hemoglobin after transfusion, and (3) the relation of the original value for recipient's hemoglobin before transfusion, to the amount of increase in the value for hemoglobin in the recipient's vessels after transfusion.

METHOD

All of the transfusions consisted of 500 cubic centimeters of blood administered by the citrate method of Lewisohn, as described by Lundy. The blood was given to the recipients immediately after its withdrawal from the donors and was administered at the rate of 500 cubic centimeters in 30 minutes.

Determinations of hemoglobin were made with the Cenco-Sheard-Sanford photometer according to the technique described by the inventors. (3) The same machine was used for all of the determinations. The value for hemoglobin of the donor's blood was determined at the time the blood was being withdrawn for transfusion. Determinations of hemoglobin of the recipient's blood were made immediately before transfusion and again 3 minutes after transfusion had terminated.

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Abridgment of thesis submitted by Dr. Sibley to the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

The value for hemoglobin of the recipient's blood was determined again at the end of the first, second, fourth, sixth, eighth, and tenth days following transfusion. An untoward reaction was considered to have taken place when chills occurred and body temperatures were 100 degrees F, or more, after transfusion.

The changes that occurred in the values for hemoglobin of the recipients are expressed as a mean average increase. Thus, in a group of cases in which the average value for hemoglobin was 9 grams per 100 cubic centimeters before transfusion, the value was 10.5 grams per 100 cubic centimeters 2 days later. Hence, the change was an increase of 1.5 grams per 100 cubic centimeters 2 days after transfusion.

OBSERVATIONS

The results of the observations are expressed in Figures 1 to 5, inclusive. The figures and legends are self explanatory. Table I is included to show the changes expressed in percentage rather than in grams.

Considering all types of cases without regard to presence or absence of bleeding after transfusion and including cases in which there were reactions to transfusion, it was readily seen that, ordinarily, in the general run of cases there was a gradual increase in the value for hemoglobin to 1.5 grams per 100 cubic centimeters (about 9 per cent) more than the original value, by the end of the second day after transfusion. This value dropped off to 0.9 gram per 100 cubic centimeters (approximately 5.4 per cent) on the eighth to the tenth day after transfusion (Fig. 1).

A different picture from the foregoing was obtained when there was no evidence of bleeding and no sign of reaction following transfusion. Thus, in one group of cases in which there were no reactions and no bleeding after transfusion—(Fig. 2, smoother curve)—there was a gradual increase in the value for hemoglobin to 2.12 grams per 100 cubic

the leg on the thigh. These tears occurred only after the internal lateral ligament had first given way, and the internal meniscus had displaced into the joint cavity.

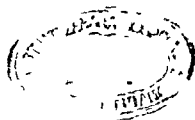
While the crucial ligament tears do occur alone, concomitant injuries to the crucial and internal lateral ligaments and not infrequently to the internal meniscus in addition, are far more frequent, and probably follows such a mechanism as Pringle utilized experimentally.

CONCLUSIONS

The prime significance of the collateral ligaments especially the internal in the integrity and stability of the knee joint and the secondary importance of the cruciate ligaments, are demonstrated by these anatomical studies. They serve to substantiate the clinical experience of several observers, viz., that the integrity of the knee joint is not markedly altered if the crucial ligaments alone are torn or excised, provided the collateral ligaments remain intact, that the tests usually considered indicative of cruciate ligament tear, are evidence of collateral ligament injury as well, and that normal knee joint stability may be restored by the simpler repair of the internal collateral ligament injury alone, disregarding the associated cruciate ligament tear.

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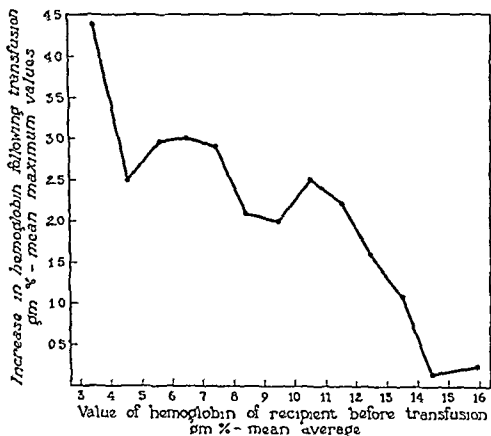


Fig 4 Increases in the values for hemoglobin following transfusion in a group of 99 cases, compared to the original values for hemoglobin in those cases before transfusion

of increase in the value for hemoglobin after transfusion. And the more nearly the value for hemoglobin before transfusion approached the accepted "normal" the closer approach there was to no increase at all in the value for hemoglobin after transfusion. The foregoing is based on the giving of a single dose of 500 cubic centimeters of blood.

There appeared to be no constant relationship between the value for hemoglobin of the donor's blood and the amount of increase in value for hemoglobin of the recipient's blood, when the values for hemoglobin of the donors were between 11 grams per 100 cubic centimeters and 19 grams per 100 cubic centimeters (Fig 5). But, when the value for hemoglobin of the donor's blood was so high that it corresponded with that of polycythemia, there was a tendency for an additional increase in the value for hemoglobin of the recipient's blood after transfusion, the increase corresponded, more or less, to the extra amount of hemoglobin added by this type of blood.

SUMMARY

In the average case in which 500 cubic centimeters of citrated blood was given by transfusion, there was an increase of about 1.5 grams per 100 cubic centimeters (about 9 per cent) in the value for hemoglobin of the recipient's blood. This increase occurred at the end of the second day after transfusion

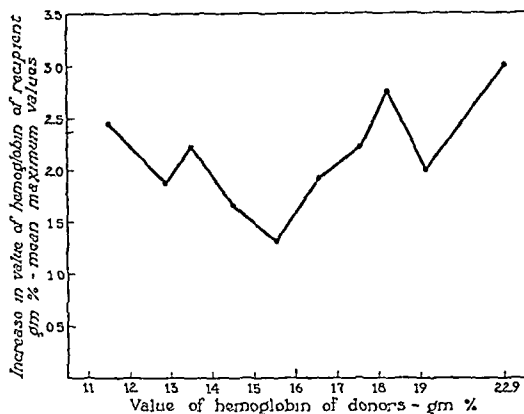


Fig 5 Increases in the values for hemoglobin following transfusion in a group of 99 cases compared to the values for hemoglobin of the donors

and tended to drop off to about 1.0 gram per 100 cubic centimeters (approximately 6 per cent) by the tenth day after transfusion.

It appeared that when 500 cubic centimeters of citrated blood was given by transfusion, an increase in value for hemoglobin of 2.12 grams per 100 cubic centimeters (about 12.72 per cent) to 2.8 grams per 100 cubic centimeters (about 16.8 per cent) could be expected in those cases in which reactions to transfusion did not occur and in which bleeding did not follow transfusion.

The amount of increase in value for hemoglobin of the recipient of 500 cubic centimeters of citrated blood was directly proportional to value for hemoglobin of recipient before administration of transfusion.

There was definitely less increase in the value for hemoglobin of the recipient, as a rule, when a reaction to transfusion occurred than when a reaction did not occur. In the average case there was but 50 per cent as much of an increase in the value for hemoglobin after transfusion of 500 cubic centimeters of citrated blood when a reaction occurred than there was when a reaction did not occur.

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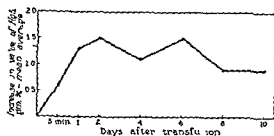


Fig 1 Increase in the value for hemoglobin following transfusion in a group of 99 consecutive unselected cases. In the text we have spoken of the cases as the general run of cases.

centimeters (about 12.72 per cent) by the tenth day and in another, larger group, (Fig 2 more jagged curve) there was an increase in the value for hemoglobin after transfusion to 2.8 grams per 100 cubic centimeters (about 16.8 per cent) by the second day. The value, although not steady, continued high as long as the observation was continued, namely until the tenth day when the figure was 2.12 grams per 100 cubic centimeters (approximately 12.72 per cent) above the original value.

The occurrence of reactions following transfusion produced rather marked effect on the final value for hemoglobin. It was seen that when reactions occurred there was much less increase in value for hemoglobin after blood transfusion than when reactions did not occur.

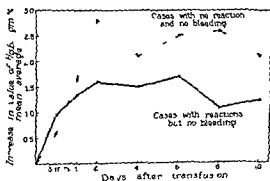


Fig 3 Comparison of the increase in value for hemoglobin following transfusion of a group of 55 patients who did not have reactions to transfusion and who did not bleed after transfusion with the increases of a group of 55 patients who did have reactions to transfusion but who did not bleed after transfusion.

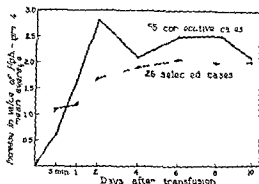


Fig 2 Another curve. Increase in the value for hemoglobin following transfusion of a group of 55 patients taken at random who did not have reactions and who did not bleed after transfusion. More jagged curve. Increase in the value for hemoglobin following transfusion of a group of 55 consecutive patients who did not have reactions and who did not bleed after transfusion.

In making this comparison to show the effect of reactions on the hemoglobin curve after transfusion, only patients who were not bleeding afterward were used in order to maintain usual conditions (Fig 3).

The relation of the value of the hemoglobin of the recipient before blood transfusion to the amount of increase in the value for hemoglobin after transfusion was found to be directly proportional (Fig 4). Thus, the lower the value for hemoglobin of the recipient before transfusion the greater would be the amount

TABLE 1 — THE BEHAVIOR OF THE HEMOGLOBIN AFTER TRANSFUSION OF 500 CCM OF CITRATED BLOOD. MEAN AVERAGE INCREASES IN VALUE EXPRESSED IN PER CENT RATHER THAN IN GRAMS

Cases	Time after transfusion	Days						
		30 min	Days					
			1	2	4	6	8	10
99 consecutive general run		1.60	7.80	9.00	6.00	9.00	5.4	3.40
65 without reaction		3.00	8.40	10.00	9.2	11.10	10.40	8.04
30 with reactions		8.2	8.10	9.00	9.00	9.00	6.54	5.70
55 with reaction and no bleeding		1.6	9.00	8.00	6.00	15.00	5.00	12.22
2 with reaction and bleed		5.82	8.10	9.00	9.00	1.20	6.45	6.75
26 with reaction and bleed		7.20	7.4	6.00	7.4	1.10	2.00	11.22



Fig 1¹ Lateral view of fetus *in utero* from Case 2. The thickening and increased density of the skin around the head is clearly seen as a definite dark shadow

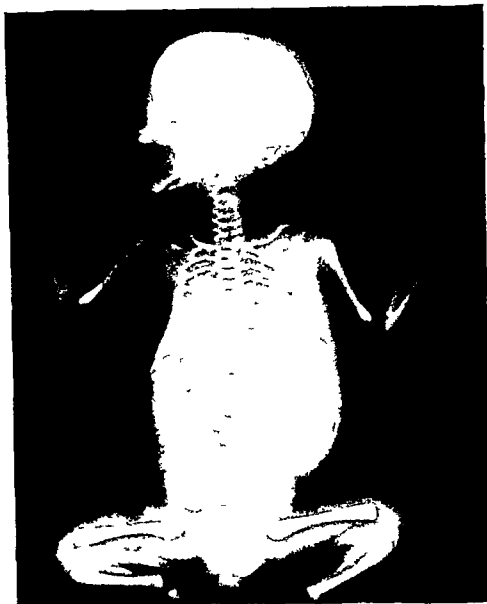


Fig 2 Anteroposterior view of fetus from the same case showing thickening and increased density of the soft parts especially the scalp

ing month her red count rose to 4.7 million and the hemoglobin to 67 per cent

On July 6, 1937, when she was 2 weeks from term by dates, she complained that she could no longer feel fetal movements. The fetal heart sounds could not be made out. The roentgenogram showed a small fetus lying in the transverse position with an elbow over the pelvic outlet. The scalp was definitely thickened and of such increased density that a dark corona was visible around the infant's head so that the diagnosis of erythroblastosis of the hydrops variety was made on the basis of the x-ray findings (Fig 1).

She went into labor spontaneously the next day. A foot was brought down and a fillet attached. She was subsequently delivered of a stillborn, 2,600 gram, edematous, female infant. The diagnosis of erythroblastosis of the hydrops variety was confirmed at postmortem examination and on gross and microscopic examination of the placenta. Roentgenogram of the fetus showed thickening and increased density of the soft parts, especially the scalp (Fig 2).

CASE 3 Mrs E. C., U. H. 13627. The mother was a 40 year old, white, American born octipara. Her first 4 children were delivered normally in 1923, 1924, 1927, and 1932, respectively. They were living and well at the time of this pregnancy. The fifth child, born in 1932, was stillborn. The sixth child

¹These photographs of the roentgenograms have been retouched with an air brush to increase the contrast of the shadows for the purpose of reproduction. The shadows, however, all retain their original relationship.

was stillborn in 1934 following a pregnancy complicated by mild toxemia and hydramnios. The placenta showed pathological changes typical of erythroblastosis of the hydrops variety. The seventh child, born 1 year later, lived only 30 minutes. The diagnosis of erythroblastosis of the hydrops variety was confirmed at postmortem examination and on gross and microscopic examination of the placenta. The mother's past and family histories were entirely negative. The blood test for syphilis was negative. She was seen in the prenatal clinic on June 2, 1937, when she was 10 weeks from term. The roentgenogram showed a fetus compatible with the dates given. The vertex presented. There was no thickening of the soft parts.

The patient developed a mild, acute hydramnios, and a mild toxemia. Roentgenograms, taken on August 2, 1937, and August 11, 1937, showed a gradual increase in the thickness and density of the soft tissues on the arms and neck. The abdominal shadow of the fetus was protuberant and suggestive of ascites. The fetal heart sounds disappeared in August. On August 20, 1937, in spite of some improvement in the patient's toxemia, the diagnosis of erythroblastosis of the hydrops variety was definitely established by x-ray. The fetal scalp was greatly thickened and appeared as a dark corona surrounding the skull.

On August 27, the mother was delivered of a stillborn, 3,110 gram, edematous, female child. The diagnosis of erythroblastosis of the hydrops variety was confirmed by the appearance of the infant, by

THE X-RAY DIAGNOSIS OF ERYTHROBLASTOSIS

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THE diagnosis of erythroblastosis in both its forms, congenital hydrops and icterus gravis, can be made with a fair degree of ease and certainty by means of physical examination of the diseased infant. The work of Schridde, Rautmann, Clifford and Hertig, Diamond, Blackfan, and Baty and Ferguson indicates that it can be established definitely on postmortem examination. Diamond has shown that there is a 30 per cent familial incidence and Hellman and Hertig have recently demonstrated that there is a 50 to 80 per cent chance recurrence in the same family. However the prenatal diagnosis of the disease until this time, has largely been a matter of conjecture. It is the purpose of this paper briefly to present three instances of erythroblastosis of the hydrops variety in which the diagnosis was established prior to the birth of the infant.

PRESENTATION OF CASES

CASE 1 Mrs. H. W. U. H. 14577. The mother was a white 37 year old American born duo decimipara. There had been 8 previous normal pregnancies in 1914, 1916, 1917, 1918, 1920, 1921, 1925 and 1927, respectively. One of twins born in 1921 died at birth. The ninth pregnancy ended in the birth of a 15 pound stillborn infant. The tenth pregnancy in 1932 was terminated by the birth of a stillborn jaundiced, and edematous infant. In 1934 the patient was delivered of a stillborn infant suffering from erythroblastosis of the hydrops variety. This diagnosis was confirmed at the post mortem examination. The twelfth pregnancy occurred in 1937. She entered the hospital on April 6, 7 weeks from term, with a moderately severe degree of toxemia. She had gained 20 pounds in weight and had suffered from dyspnea and orthopnea for 6 weeks. She weighed 295 pounds, her blood pressure was 154/92 and there was a trace of albumin in the urine. The laboratory test for syphilis was negative. At this time anteroposterior and lateral roentgenograms of the pelvis were taken with the following technique: kilovolts 6 milliamperes

From the Department of Pathology and the Department of Obstetrics, Harvard University Medical School and the Boston Lying in Hospital.

The Hinton test was used throughout.

*Similar modified soft tissue technique is used throughout.

50 distance 25 inches time 3 seconds anteroposterior and 45 seconds lateral. The roentgenograms showed an infant of good size with the vertebrae presenting. There was definite thickening and increased density of the soft parts which was so marked over the head that a definite dark corona was visible. There was also enlargement of the abdomen suggestive of ascites.

She went into labor spontaneously on April 12, 1937. At the onset of labor the fetal heart was well made out. As labor progressed however the patient bled profusely and a Spanish windlass binder was applied to her abdomen. A Braxton Hicks version was performed and a foot brought down. When the os was fully dilated a breech extraction was performed and a stillborn edematous female infant weighing 3600 grams was delivered.

The diagnosis of erythroblastosis of the hydrops variety was confirmed at postmortem examination of the infant and on gross and microscopic examination of the placenta which presented the picture described by Hellman and Hertig. Soft tissue roentgenogram of the dead fetus showed an increase in density and great thickening of the soft parts which was especially marked over the head and neck and was due to an intense subcutaneous edema. It was not however until the second series of plates were made that the significance of the changes of the fetal soft parts seen *in utero* was fully appreciated.

CASE 2 Mrs. G. B. U. H. 19067. The mother was a 22 year old American born tripara. Her first child born in 1933, was normal. The second pregnancy terminated in 1936 with the normal delivery of a 3720 gram male infant which developed jaundice during the first 12 hours of life. It became progressively more icteric and died suddenly on the sixth day of life. The diagnosis of erythroblastosis of the icterus gravis variety was made at post mortem examination.

The mother had had purpura hemorrhagica during infancy otherwise her past and family histories were essentially negative. The blood test for syphilis was negative.

When first seen in the prenatal clinic during the present pregnancy she was 4 months from term by dates. Her hemoglobin was 37 per cent and her red cell count was 3 million. Otherwise she was entirely well. The baby was active and x-ray plate showed a fetus compatible with the stated duration of pregnancy. There was none of the thickening of the soft parts seen in the previous case. Patient was given large doses of iron, vitamin B and intramuscular injections of liver extract. During the follow

THE THECA INTERNA CONE AND ITS RÔLE IN OVULATION

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PHYSIOLOGICAL changes in the ovary are controlled by endocrine glands, especially the pituitary body. The most important process is the periodic ripening and bursting of the follicles. Knowing fairly well the influences exerted by the endocrine glands, we take for granted the histological factors concerned in this process. We do not realize that growth and rupture of the graafian follicle is a mechanical process, which requires definite anatomical preparations.

Both processes, delivery of the fertilized ovum from the uterus and delivery of the unfertilized ovum from the ovary, have two etiological factors in common, the endocrine stimulus and the mechanical procedure. For instance, the fertilized ovum, at the time of its fullest development is delivered from the uterus by the mechanical process known as "labor", this process has been studied carefully and is well understood on account of the practical necessity for such knowledge in obstetrics. In the case of delivery of the unfertilized ovum, the ascensus and rupture of the graafian follicle, the mechanical process has been neglected because of lack of the practical necessity for such knowledge.

The fact that follicles grow and become cystic is not sufficient to explain their bursting. Other cysts of the ovaries attain the size of a man's head and larger without bursting. This very fact, the difference between the physiological behavior of graafian follicles and that of pathological cystomas is the reason for studying this problem by histological means.

The work I am recording in this report was begun at the Pathological Institute of the University of Freiburg under Professor Dr. Ludwig Aschoff, continued at the University of Berlin, and is now brought to an end, it makes possible definite conclusions not only regarding human beings but also regarding various orders of mammals. Any normal physiological

and histological process can be regarded as typical only if it is found to occur not only in human beings, but also in other different groups of mammals.

In my first study (2) I demonstrated that it was the eccentric growth of the follicle in contrast with the concentric growth of the cysts which brought about the ascensus of the follicle to the surface of the ovary where finally rupture occurs. It was observed that in human ovaries the theca interna proliferated more markedly toward the surface of the ovary, being two, three, and more times thicker at this point than toward the hilus where the theca externa, consisting mostly of fibers of connective tissue, surrounded the follicle firmly like a goblet, preventing development toward the hilus of the organ.

This one-sided proliferation of the theca interna determines the path the growing follicle will travel. It was possible to give statistical evidence by arranging 62 growing follicles into groups according to size, and by measuring and calculating the average distance of the follicle from the nearest point on the surface of the ovary (Table I).

The primordial follicles are located just below the albuginea. The growing follicles move at first, deeper into the ovarian substance. This movement is passive, and is caused by the diminished pressure toward the hilus of the organ and the increased pressure of the cortex. The result is seen in the increase of average distance in group 3 as compared with group 1. In group 3 the distance from the surface is longest. At this moment the follicles start to return to the surface of the ovary. This movement is an active one caused by the appearance and action of the theca. It is in this group that the formation of liquor sets in, usually in the peripheral pole of the membrana granulosa in human follicles, and the surrounding ovarian stroma forms the two thecal layers (Fig. 1).

The theca interna is the more important one. It consists of numerous spherical or

Work done in the University of Freiburg and in the University of Berlin (where the author was privatdozent for Gynecology and Obstetrics), and completed in The Mayo Foundation.

postmortem examination and on gross and microscopic examination of the placenta¹

Similar x ray changes could not be demonstrated in fetuses suffering from erythroblastosis of the icterus gravis variety

SUMMARY AND CONCLUSIONS

In the 3 cases presented the diagnosis *in utero* of erythroblastosis of the hydrops variety depended upon the presence of advanced edema of the soft parts. This edema is seen in the roentgenogram as a thickening and increased density of the soft parts. It is so striking in the scalp that a definite corona is seen surrounding the skull. Ballantyne and Esche have shown that certain congenital defects such as congenital heart disease, large tumors of the chest and abdomen producing compression of the superior or inferior vena cava can produce similar edema.² In the experience of the Boston Lying in Hospital such congenital defects are extremely rare. On the other hand, erythroblastosis of the hydrops variety has occurred once in 2,000 deliveries. The fact that this form of erythroblastosis is incompatible with life should make the diagnosis of the condition *in utero* of more than academic interest. It has been our policy during the past year to examine by

x ray all mothers who give a history of having had previous erythroblastotic children. Roentgenograms should be taken at least every 2 weeks during the last 2 months of the pregnancy.

In 2 of the 3 cases of erythroblastosis of the hydrops variety here presented the diagnosis was made by the x ray while the fetus was still *in utero*. In the other case, the diagnosis could have been so made.

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¹ The history of this patient during the latter part of her pregnancy was as follows: The delivery was a difficult one. Dr H. M. Teel, who was the surgeon, reported that the placenta was not delivered. The fetus was dead at the time of delivery. The cause of fetal death was not determined. The cause of the edema could not be determined at autopsy.

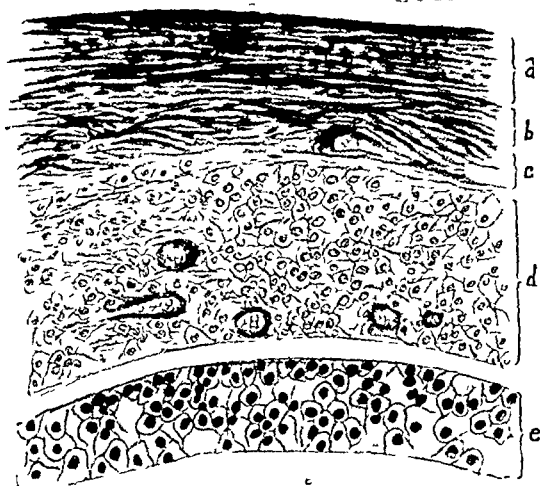


Fig 3 Large human follicle. Peripheral part, toward surface of the ovary. Marked thickness of theca interna. Small theca externa, *a*, albuginea, *b*, stroma, *c*, theca externa, *d*, theca interna, *e*, granulosa ($\times 225$)

trude. The difference between the broad proliferating theca interna at the upper part of the follicle and the small one at the basal part becomes even greater. Figures 3 and 4 represent sections from the same large follicle and are observed under the same power of magnification.

After the follicle reached the surface of the ovary the layers became progressively thinner, owing to the fact that the inner pressure is stronger than the outer pressure. The vertex of the follicle becomes atrophic and gives way usually without any bleeding. The one-sided proliferation of the theca interna was confirmed by Wilfred Shaw, who investigated my work and came to the same opinion regarding the rise of the follicles to the surface. In spite of this confirmation the problem of the penetration of the follicle toward the surface of the ovary did not seem to have been studied sufficiently.

In another study (3) I investigated the whole problem again using ovaries from humans and from cats, arranging them in series as had been done previously. Finally, with Erika von Moellendorff, I (4) studied ovaries of various other mammalian orders, the organs of which could be obtained. We studied Carnivora (dog), Rodentia (rabbit), and Un-

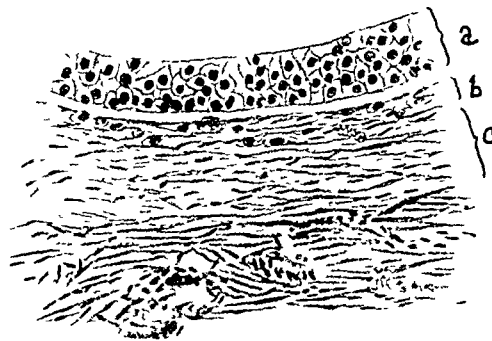


Fig 4 Same follicle as that represented in Figure 3. Basal part, toward hilus. Small theca interna. Broad theca externa, *a*, granulosa, *b*, theca interna, *c*, theca externa ($\times 225$)

gulata (swine, cow, and horse). Table II illustrates a summary of the various groups. A large number of slides was investigated because it was necessary to study each ovary from serial sections.

I would prefer not to consider the histological and technical details involved or the various investigations and findings, these can be found in the references if desired. There is one point to be mentioned, namely, that it was important to obtain the ovaries from animals in the pre-estrus stage. Otherwise one would not find typical growing follicles.

The one-sided proliferation of the theca interna toward the surface as found in ovaries from humans was confirmed in the cat and later in all animals examined. We would not discuss the whole problem again, if new phe-

TABLE II — MAMMALIAN OVARIES EXAMINED

Genus	Order	Microscopic sections, number
Man	Primates	3,000
Cat	Carnivora	3,000
Dog	Carnivora	1,917
Rabbit	Rodentia	1,423
Swine	Ungulata	3,108
Cow	Ungulata	2,874
Horse	Ungulata	3,059
Total		18,381

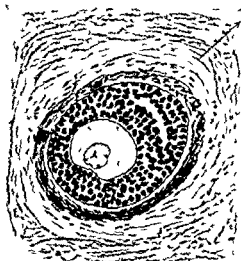


Fig. 1 Small human follicle diameter 0.22 millimeter. Formation of thecal layers and cavity in peripheral portion just commencing. Arrow points to surface of ovary ($\times 162$).

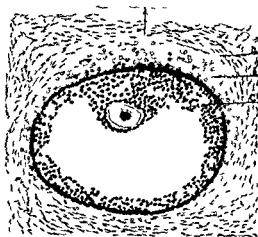


Fig. 2 Human follicle of medium size. One-sided proliferation of theca interna toward surface of the ovary which lies in direction indicated by arrow. *a* theca externa; *b* theca interna; *c* granulosa ($\times 102$).

ovoid cells. Many cells show mitosis, a sign of proliferation. The theca externa consists of fibers of connective tissue and few nuclei. This layer is not much different from the stroma of the ovary; the fibers surrounding the follicle in concentric circles. Many capillaries are present in the theca interna; few of them occur in the theca externa.

Soon after the formation of the thecal layers the eccentric growth of the theca interna toward the surface of the ovary commences (Fig. 2). With this histological change which is observed in all growing follicles, the distance

Figures 1, 2, and 3 are drawings from specimens borrowed by the author at Arch. Dis. Pathological Inst. (1936) from Dr. E. H. G.

TABLE I — SIZE OF FOLLICLE AND ITS AVERAGE DISTANCE FROM SURFACE OF OVARY

Group	Size of follicle, mm.	Average distance of follicle from surface of ovary, mm.
1	less than 0.1	0.65
2	0.1-0.2	0.82
3	0.2-0.3	1.3*
4	0.3-0.4	0.91
5	0.4-0.5	0.5

* Development of theca.

between the follicle and the surface of the ovary becomes shorter and the ascensus of the follicle begins as is illustrated in groups 4 and 5. The question could arise as to whether it may not be the liquor in the follicle which brings about the ascensus. This cannot be the reason. In the first place the internal pressure in liquids is equal in all parts. In the second place the follicles in this stage being 0.3 to 0.5 millimeter in diameter are too small to exercise any considerable pressure against the surrounding tissues.

It was mentioned that the formation of liquor usually takes place in the peripheral pole of the follicle. In small human follicles the cumulus ovisculus is found; therefore, in the basic hemisphere. In the larger follicles the cumulus ovisculus is more often found in the peripheral hemisphere, an observation which has been verified by other authors. How this may be explained was discussed in the report of the study that has been mentioned.

The larger follicles which are visible to the naked eye have a diameter of more than 0.5 millimeter and give evidence of beginning protrusion of the surface of the ovary. To have calculated the average distance from the albuginea would have been misleading because the upper layers of the ovary also pro-

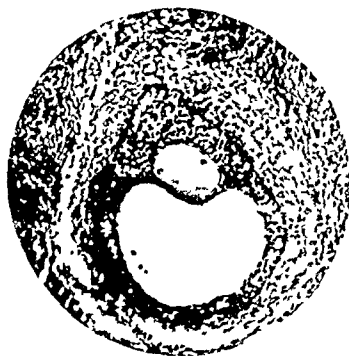


Fig 8 Human follicle Theca interna cone, cone shaped granulosa, both pointing toward surface of ovary ($\times 100$)



Fig 9 Follicle of a cow Cone shaped theca interna and granulosa pointing toward surface of the ovary ($\times 43$)

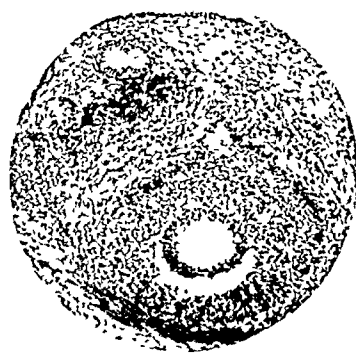


Fig 10 Follicle of a dog Cone shaped theca interna and granulosa pointing toward surface of the ovary ($\times 43$)

Figure 5 shows a small elliptical follicle of the cat. The granulosa at both poles is thickened as has been described in former papers. In the peripheral pole the formation of the liquor is just beginning. On top of this peripheral pole the theca interna is situated, wedge-shaped, triangular; the axis of this cone points toward the region of primordial follicles, which is the cortex.

Figure 6 illustrates a small follicle of a rabbit with the same theca interna cone on top of the peripheral pole of the follicle. Figure 7 illustrates two follicles of a rabbit with the typical theca cone both pointing vertically to the nearest part of the surface of the ovary.

It is noticeable that the surrounding connective tissue undergoes marked edematous softening which aids the ascensus of the fol-

licle. This edema is not present in the same amount in the ovaries of various animals. It is more obvious in the ovaries of rabbits and of swine than in the ovaries of humans or other mammals.

In the group of medium sized follicles one observes the effect caused by proliferation of the theca interna. Figure 8 illustrates a human follicle. The thecal wedge is fully visible. The granulosa, protruding into the thecal cone, becomes wedge-shaped itself. Following the line of least resistance, the follicle, growing in size owing to increasing formation of liquor and proliferating granulosa, follows the path determined by growth of the theca interna.

Figure 9 illustrates the same conditions in a follicle of a cow. Figure 10 illustrates that of a dog, Figure 11 that of a rabbit, and Figure

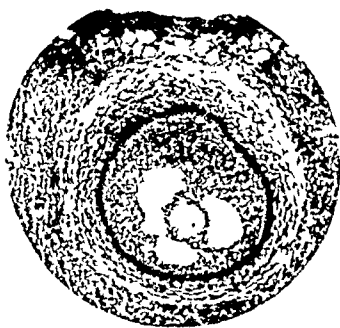


Fig 11 Follicle of a rabbit Cone shaped theca interna and granulosa pointing toward the surface of the ovary ($\times 43$)

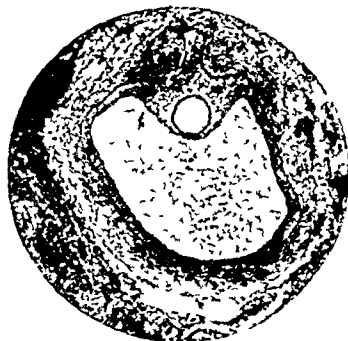


Fig 12 Follicle of a horse Theca interna cone and protrusion of granulosa pointing toward ovulatory fossa ($\times 37$)



Fig 5¹ Theca interna cone pointing toward the surface of the ovary Small follicle of a cat ($\times 100$)



Fig 6² Theca interna cone pointing toward the surface of the ovary Small follicle of a rabbit ($\times 43$)

nomena had not been observed facts which were rather unexpected and found to be typical histological processes in an organ so thoroughly investigated by various authors for more than 50 years

The growing follicle develops a sprout such as any seed develops for instance the bean or pea and demonstrates a definite "tropism" toward the nearest point of the surface of the ovary The one sided proliferation of the theca interna proved to be only the base of the sprout The proliferation was found by examining serial sections cut in different directions To observe the sprout, serial sections had to be cut in a direction at a right angle to the surface In these slides one finds that the proliferation of the theca interna forms a cone at the uppermost part, which has a triangular wedge shaped, cut surface

FIGURES 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 are photographs of the sections prepared by the author T P Strassmann's Clinic, Berlin

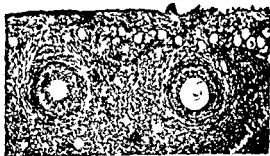


Fig 7 Theca interna cones of two small follicles of a rabbit pointing toward surface of ovary Edema in theca externa around thecal wedges ($\times 45$)

This theca interna cone is always located at the peripheral hemisphere of the follicle in other words on that part which is closest to the surface of the ovary The axis of this cone points always to the nearest part of the albuginea The cone covers the follicle like a roof the angle of which is sharp at first, then it becomes a right angle and finally becomes an obtuse angle in accordance with the increasing size of the follicle The cone is formed by proliferating cells of the theca interna, ploughing a path for the follicle, like the bow of a ship The cone divides the surrounding tissues like a wedge, providing a space of lower resistance it pushes other follicles or corpora lutea, corpora fibrosa, and albicantia aside exercising even a kind of suction The follicle follows passively, always closed by the membrana limitans The increasing amount of liquor and the growing granulosa help to fill the space thus provided until the surface of the ovary is reached and the function of the theca interna cone has been fulfilled

I shall illustrate these formations from the various sized groups of follicles from humans and animals Then I shall discuss some differences between the various mammalian orders and finally I shall consider why in an organ so thoroughly investigated as the ovary has been in the past so typical and important a peculiarity as the theca interna cone could have escaped earlier observation

FIGURES 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 are photographs of the sections prepared by the author T P Strassmann's Clinic, Berlin

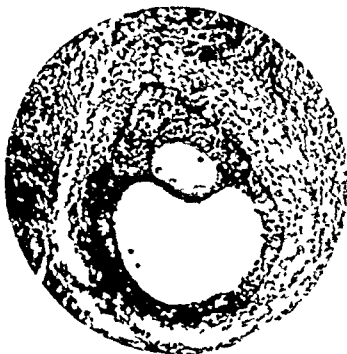


Fig 8 Human follicle Theca interna cone, cone shaped granulosa, both pointing toward surface of ovary ($\times 100$)

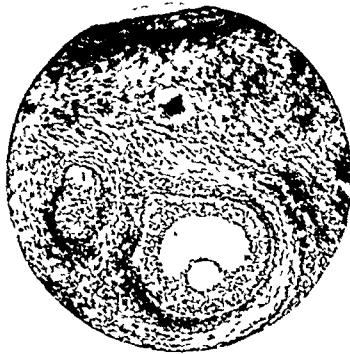


Fig 9 Follicle of a cow Cone shaped theca interna and granulosa pointing toward surface of the ovary ($\times 43$)

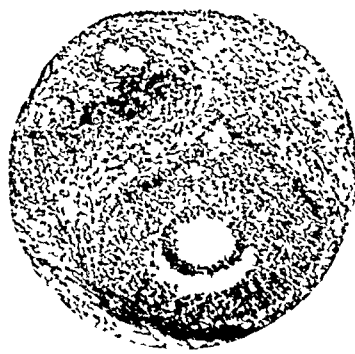


Fig 10 Follicle of a dog Cone shaped theca interna and granulosa pointing toward surface of the ovary ($\times 43$)

Figure 5 shows a small elliptical follicle of the cat. The granulosa at both poles is thickened as has been described in former papers. In the peripheral pole the formation of the liquor is just beginning. On top of this peripheral pole the theca interna is situated, wedge-shaped, triangular, the axis of this cone points toward the region of primordial follicles, which is the cortex.

Figure 6 illustrates a small follicle of a rabbit with the same theca interna cone on top of the peripheral pole of the follicle. Figure 7 illustrates two follicles of a rabbit with the typical theca cone both pointing vertically to the nearest part of the surface of the ovary.

It is noticeable that the surrounding connective tissue undergoes marked edematous softening which aids the ascensus of the fol-

licle. This edema is not present in the same amount in the ovaries of various animals. It is more obvious in the ovaries of rabbits and of swine than in the ovaries of humans or other mammals.

In the group of medium sized follicles one observes the effect caused by proliferation of the theca interna. Figure 8 illustrates a human follicle. The thecal wedge is fully visible. The granulosa, protruding into the thecal cone, becomes wedge-shaped itself. Following the line of least resistance, the follicle, growing in size owing to increasing formation of liquor and proliferating granulosa, follows the path determined by growth of the theca interna.

Figure 9 illustrates the same conditions in a follicle of a cow. Figure 10 illustrates that of a dog, Figure 11 that of a rabbit, and Figure

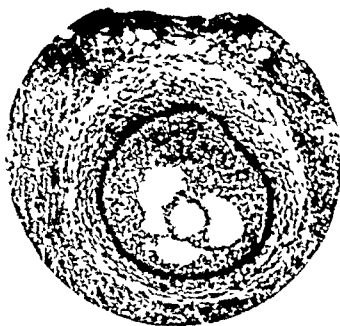


Fig 11 Follicle of a rabbit Cone shaped theca interna and granulosa pointing toward the surface of the ovary ($\times 43$)

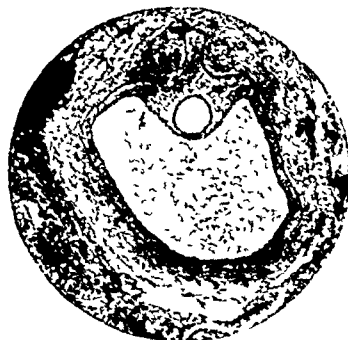


Fig 12 Follicle of a horse Theca interna cone and protrusion of granulosa pointing toward ovulatory fossa ($\times 37$)



Fig 13 Human follicle of medium size Theca interna cone Granulosa protruding in same axis toward surface of ovary (X66)

12 that of a horse All these different mammalian follicles give evidence of the same principle controlling the ascensus of the follicles The wedge shaped theca interna grows toward the surface of the ovary The interior layers of the follicle follow, dragged into the axis of the thecal cone This is especially marked in the follicle of the horse as seen in Figure 12

The protrusion of the membrana granulosa into the thecal cone is found best when the cumulus ovisgerus is located in the upper hemisphere of the follicle This is explained easily The growth of the membrana granulosa takes place mostly around the ovum Here many mitotic figures are found Fast growing tissues are soft They follow the line of least resistance more easily than slowly growing and therefore harder ones No wonder that the formation of the niche of the granulosa occurs in follicles in which the proliferation of the theca and the cumulus oophorus are adjacent

Figure 13 illustrates formation of the niche and thecal wedge in a human follicle It is noteworthy that both formations have the same axis pointing toward the cortex of the ovary which in this picture as always is recognizable by the area of primordial follicles A question could be raised as to whether the wedge-shaped granulosa possesses an active



Fig 14 Large follicle of a cat Theca interna cone and granulosa protruding toward surface of the ovary and pushing aside two degenerated follicles (X37)

propulsive power like the theca interna wedge There is one difference between these two processes The growth of the theca interna infiltrates adjacent tissues, like the syncytium of the chorionic epithelium, the granulosa on the other hand is surrounded always by a limiting membrane, and cannot infiltrate the adjacent tissues But it can follow the line of least resistance wherever the interior pressure caused by growing granulosa and increased formation of liquor admits the easiest possible expansion This is caused by the proliferation of the theca interna which works in two ways On the outer side, it softens and infiltrates the ovarian stroma, pushing other follicles aside on the inner side, it provides an area of lesser resistance toward the growing follicle because the thecal cone itself consists of a soft mass of rapidly growing cells these give way more easily than do the parts surrounding the follicle at its base and sides

By applying the Mallory and Azan stain I tried to determine whether the cells of the theca interna cause destruction or necrosis of the surrounding tissues in other words whether the thecal wedge ploughs its way not only mechanically but also chemically by digesting or dissolving cells of the stroma Besides the edema which is found in several mammalian ovaries in the neighborhood of the thecal layers especially in rabbits and swine I did not observe any chemical action lysis of cells or destruction of nuclei which would suggest presence of an enzyme The best method for distinguishing degenerating or dead cells in living tissues is by vital staining No such changes were seen on applying



Fig 15 Converging growth of two follicles of a horse toward ovulatory fossa. Marked theca interna proliferation ($\times 30$)

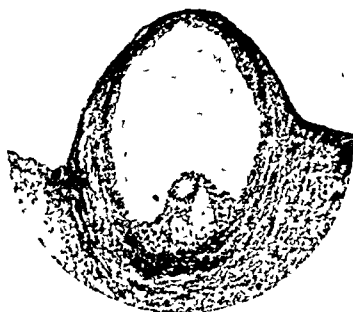


Fig 16 A rat follicle that is about ready to burst. There is present marked protrusion above the surface of the ovary ($\times 37$)

this method in the tissues surrounding growing follicles or around the theca interna wedge (4)

As a typical example of the larger group of follicles can be taken that of a cat illustrated in Figure 14. On account of size only the upper part is photographed. Two atretic follicles lie in the way of the maturing one. One notes with what strength the theca interna wedge is preparing the path for the ripening follicle between the two atretic follicles by pushing them aside. It is not necessary to show the same illustrations for the various mammalian orders. The larger the animal, the larger is the ovary, and the more marked is the thecal wedge and the thecal proliferation.

In small animals, such as the mouse, the follicles are near the surface. There is no need for much action of the theca interna because development takes place directly below the surface of the ovary. Therefore, I did not see very marked formations of a wedge in the ovaries of mice. In the slightly larger animal, the rabbit, the formation of a wedge was very well developed. Likewise, all the others, without exception, exhibited well developed formation of wedges.

Particularly interesting were the findings in horses, for they gave the possibility of determining whether my opinion concerning the significance of the proliferation of the theca interna and the formation of wedges was correct, while in the other mammals the ovaries have an entirely free surface which

permits ovulation to occur at any place on their surface, excluding the hilus. The ovary of the horse is surrounded by mesovarium, blood vessels, and connective tissue, leaving only one little spot free, the ovulatory fossa where ovulation takes place and at which point ova enter the peritoneal cavity.

In all other mammals studied the wedges of theca interna grew divergently toward the nearest point on the surface of the ovary. In horses proliferation of the theca converges toward the ovulatory pit. Figure 15 illustrates two follicles of an ovary of a horse, the axes of which converged toward one point, which proved to be the ovulatory pit. The proliferation of theca interna is well marked in both follicles, the points of the thecal wedges were in two different slides. I took this particular slide for reproduction because it demonstrates the intact ova in both follicles and thereby gives evidence that the converging growth of the theca interna occurs in intact graafian follicles.

A definite theca interna cone in a follicle of a horse is illustrated in Figure 12. When ascensus of the follicle through the ovarian stroma and the cortex is completed, protrusion commences (Fig 16). The theca interna wedge flattens out, forming a straight line. Proliferation ceases and the membrane between the interior of the follicle and the peritoneal cavity becomes progressively thinner. Circulation on top of the vertex of the graafian follicle is interfered with by internal pressure. The capillaries do not contain blood cells.

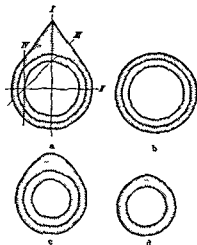


Fig. 17 Schematic outline of follicle with theca interna cone. Figures a b c d are obtained when follicle is cut following lines I II III IV respectively

Atrophy sets in at the stigma. The rupture of the follicle takes place in a very smooth manner. After ovulation has occurred the follicle collapses and the walls begin to form the corpus luteum. One cannot confuse the theca interna cone of intact, growing follicles with the changes of the theca interna in follicular degeneration if one observes the following differences:

1. The theca interna cone is present only at one point of the follicle which is always the vertex of the peripheral hemisphere and closest to the free surface of the ovary. The transformation of the theca in degenerating follicles is observed at all sides.

2. Among the cells of the theca interna cone are numerous mitotic figures seen on high power of magnification (hyperplasia). Among the cells of the theca interna in degenerating follicles almost no mitotic figures are seen; instead the change is one of hypertrophy owing mostly to infiltration of fat.

3. The cells of the theca interna cone form a solid closed formation. Only the uppermost cell groups are occasionally surrounded by connective tissue fibers. The cells of the luteinized theca are arranged in groups throughout by septa of connective tissue.

4. Finally if there is any doubt examination of the ovum and the membrana granu-

losa always will make evident whether we are dealing with an intact follicle or a degenerated one.

After the description of the one-sided proliferation of the theca interna and formation of the cone toward the surface of the ovary in human beings and various mammalian orders the question arises as to why a typical histological process such as that found in the mammalian orders examined has not been discovered previously. Figure 17b may explain the difficulty, which is based on a simple mathematical consideration.

The cut surface of a sectioned cone appears triangular in shape only if the section passes through the apex of the cone and if its axis coincides with that of the cone, represented by line I.

If sections through a follicle are parallel to the ovarian surface represented by line II we obtain Figure 17b. All layers of the follicle appear equal on all sides. The thecal wedge would not show in any serial sections containing the cavity of the follicle.

If sections are made obliquely through the follicle, represented by line III, we obtain Figure 17c; this would show only the one-sided thickness of the theca interna and not the wedge. This would hold true only for part of the sections.

If the sections are made perpendicular to the surface of the ovary we obtain various outlines of the follicle. A section through line IV would look like Figure 17d. We may visualize the eccentric growth of the theca interna, not the wedge.

Only if the section is perpendicular to the surface of the ovary and passes through the apex of the cone represented by line I is there a chance to obtain a cut surface showing the triangular shape of the wedge of the theca interna (Fig. 17a).

This is the reason why we discovered the eccentric growth of the theca interna first. It could be observed more easily than the wedge. The latter could be demonstrated only under favorable conditions. The chance of missing it, even in studying serial sections, is hundreds of times greater than the chance of finding it. This very fact made it necessary to examine a considerable number of ovaries cut in serial

sections and from various mammalian orders before we were convinced that we were dealing with a typical physiological process in the normal histology of the ovary in humans and mammals

SUMMARY

Ovulation is a mechanical process stimulated by the endocrine glands. Its mechanism can be understood only by determining how the follicle reaches the surface of the ovary.

The study is based on more than 18,000 serial sections of ovaries from humans and mammals. Four mammalian orders were represented: Primates (man), Carnivora (rat and dog), Rodentia (rabbit), and Ungulata (swine, cow, horse).

Eccentric growth of the theca interna of the growing follicle was found in all species examined. This one-sided proliferation of the theca interna is always directed toward the surface of the ovary. It forms a cone which is wedge-shaped on the cut surface, infiltrates and penetrates the surrounding tissues, thus making a path for the growing follicle.

The growing graafian follicle ascends to the surface of the ovary by following the line of least resistance which is provided by the cone of the theca interna. The average distance between follicle and ovarian surface becomes

shorter with the appearance of thecal proliferation.

In human and mammalian ovaries which have much free ovarian surface, the axis of the thecal cone is directed toward the nearest point on the surface of the ovary. In horses, where the surface of the ovary is surrounded by connective tissue (mesovarium) the axis of the cone of the theca interna is directed toward the only free spot on the surface of the ovary, that is the ovulatory fossa.

The wedge-shaped theca interna cone can be demonstrated only in sections which run through the apex of the cone perpendicularly toward the ovarian surface. A more or less marked degree of edema is present in the surrounding tissues, which facilitates the mechanical progress of the ascending follicle.

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THE ETIOLOGY OF EXTRA-UTERINE PREGNANCY

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The etiology of extra uterine pregnancy is a problem which may be said to have been under constant discussion for many a year. Many theories have been advanced in an attempt to explain the origin. Some theories were maintained for many years, others were short lived, but all of them, forgotten for a time, have again been advanced anew only to be given up. At present, it seems to be generally assumed that three factors may be concerned in bringing about ectopic pregnancy.

1. A peculiar faculty of the female reproductive cell to impart to the ovum the capacity for premature implantation, i.e., before it reaches the uterus. This may occur either because of premature development of the ovum (Schtoekel)—a hypothesis which has at present met with much criticism (Skrobansky, Pankow) and which it is impossible to investigate because, as the journey of the ovum is very long, as for instance in case of external migration, the ovum has already developed its capacity for implantation at term before it reaches the end of its journey.

2. Disturbed transportation of the ovum.

3. Mechanical obstacles encountered on the journey of the ovum which either handicap or make impossible its further progress.

A study of the third factor, i.e., the mechanical obstacles to the passage of the ovum, is the main subject of this paper. A number of writers reject the opinion that mechanical obstacles possibly cause tubal implantation of the ovum on the ground that the high motor capacity of the tube should help to overcome such obstacles, especially since the ovum which is highly elastic and is possessed of amoeboid motion readily passes through apertures considerably smaller in size than its diameter. In spite of this it is our belief that though the ovum of course may in time cover this entire, hard journey provided the

motor capacity of the tube is great and other conditions are favorable, as soon as its transportation is even slightly disturbed the mechanical obstacle will play its fatal rôle and the ovum will develop the capacity for implantation much before it reaches the uterus. The disturbance in the motor capacity of the tube may be ever so slight, but not sufficient to cause delay in the progress of the ovum to the uterus, if the ovum encounters no mechanical obstacle on its way.

We shall touch here but slightly on the second factor, i.e., the transportation of the ovum, for we hope to present later a paper on the subject based on 90 experimental observations on the human fallopian tubes at varying times during the menstrual cycle and in pregnancy. The first factor, as we have previously mentioned, can hardly be submitted to scientific research; it is taken into consideration only in cases of external migration.

We have studied in all, 100 cases of tubal pregnancy, as well as 140 cases of normal uterine pregnancy, cases of fibromyoma and other forms of gynecological affections. When possible the tubes were studied in pairs. The tubes were arranged in a system of graded sections. For this purpose the tube was divided into 20 to 25 cross segments of 11, 5 millimeters each. To prevent the tubes from forming curves they were smoothed out as far as possible previous to fixation and then pinned on to cardboard slides. All the segments were cut into sections in consecutive order on a freezing microtome and the sections were stained after the van Gieson's method. No less than 10 to 15 sections of each segment were then subjected to careful microscopic examination in which all the obstacles that might have interfered with the progress of the ovum and all the changes in the various layers along the entire length of the tube were evaluated, but primary importance was attached to the area nearest the site of im-

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plantation In estimating our material, it was found that in 24 of the cases (24 per cent) mechanical obstacles apparently played no part in causing tubal implantation of the ovum, for they were either absent or were found at a considerable distance either above or below the site of implantation, i e, the ovum had either safely passed the obstacle or the latter could not have had any effect on the progress of the ovum

Consequently, in these 24 cases the cause of tubal pregnancy should be attributed to the first or the second factor In 10 of the 24 cases it was caused by the first factor, as we had opportunity to observe the external migration of the ovum (the corpus luteum was found in the ovum on the opposite side), while in the 14 remaining cases it might have been due to the second factor In the 76 other cases (76 per cent) the tubes revealed certain changes which, as we believe, may have delayed the passage of the ovum and thus caused the development of the given tubal pregnancy. In these 76 cases, implantation may be attributed to the following causes in 8 cases, to a markedly manifest decidual reaction on the part of the mucous membrane of the tube, apparently, of hormonal origin; in 5 of the 8 cases decidua covered the whole of the mucous membrane, which in the isthmic portion of the tube resembled the endometrium in its structure and completely blocked the lumen of the tube, in the 3 other cases decidua formed patches on the septa We have studied the decidual reaction of the tube as one of the sources of ectopic pregnancy in the same material and the results of our investigations were published¹ in 1933, and, therefore, we shall not discuss the subject in the present paper In 9 cases implantation was caused by adenomyosis as has been reported in our paper "Adenomyosis and other Glandular Formations of the Tube and Their Rôle in the Etiology of Tubal Pregnancy"² In 3 of the 9 cases we have had to deal with interstitial pregnancy in connection with diffused adenomyosis of the interstitial portion of the tube closing the tubal lumen and in the 6 other cases it was diverticular pregnancy charac-

teristic of adenomyosis In 14 cases the ovum was held in the tube because of inflammation, in 21 cases this was due to adhesion of the folds, in 21 cases this was caused by defects of tubal development, and in 3 by tumors

First we shall discuss inflammation as one of the oldest etiological causes of tubal pregnancy We believe this to have been responsible for 14 cases of tubal pregnancy (14 per cent) of the total number of cases we have observed In 3 cases the ovum was implanted in a diverticulum of an inflammatory nature (the case has been described in a previous paper), in 3 cases obliteration of the lumen of the pregnant tube was observed within a limited region (*pars isthmica tubæ*), while the opposite tube was permeable and had apparently allowed the passage of the spermatozoon which then impregnated the ovum. In 6 cases tubal pregnancy was due to numerous adhesions around the tube which had caused marked curvations of the tubal lumen forming acute angles, in one of which the ovum had become implanted In 2 cases it was caused by acute inflammation, for the lumen of the tube below the site of implantation was completely blocked with edematous and infiltrated folds We have observed also another case of acute purulent inflammation of the tube, but we do not include it among the cases here reported, for the patient on noticing a delay of menstruation had applied to a midwife who attempted to produce abortion by introducing a bougie, with the result that the patient developed a feverish condition

The inflammatory theory seems to be the oldest and at the same time the most widely prevalent and stable of all, though the explanation as to exactly why inflammation should be the cause of tubal pregnancy has been repeatedly altered The older writers used to attribute it to perisalpingitis, which causes varied curves in the tube and consequently handicaps the forward passage of the ovum Later, after the publication of Hoehne's work, the rôle of perisalpingitis was no longer considered to be of importance Only recently have certain authors begun again to speak in its favor (Pankow) We believe that, in a comparatively high percentage of cases, i e, in 6 of the 14 cases attributed to inflammatory

¹Monatsschr f Geburtsh u Gynæk, 1933, vol 94
²Schweiz med Wchnschr 1935, 65 No 30

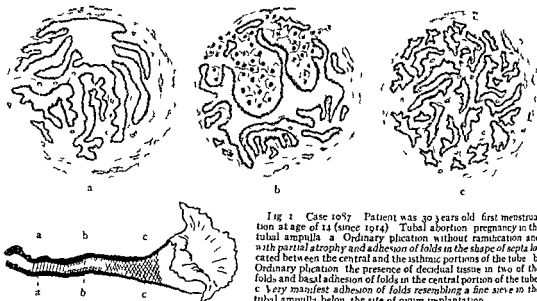


Fig 1 Case 1087 Patient was 30 years old first menstruation at age of 14 (since 1914). Tubal abortion pregnancy in the tubal ampulla. a Ordinary plication without ramification and with partial atrophy and adhesion of folds in the shape of septa located between the central and the isthmic portions of the tube. b Ordinary plication the presence of decidual tissue in two of the folds and basal adhesion of folds in the central portion of the tube. c Very manifest adhesion of folds resembling a fine sieve in the tubal ampulla below the site of ovum implantation.

causes, perisalpingitis was the cause of the tubal pregnancy. We must add that in such cases we generally find in addition to the adhesions which cause curvation of the tube, numerous scars in the muscular tissue of the tube which also prevent the latter from sufficiently increasing its motor activity to overcome the resulting resistance. The effect produced by the inflammation of the tube on the migration of the ovum is evaluated in different ways by various authors: the majority believe it to be due to cicatricial changes in the musculature (Skrobansky, Pankow etc), while others chiefly the adherents of Hoehne's theory, attribute it to the fact that the tubal epithelium has lost its vibrating property. Other present day authors consider that, among the inflammatory factors causing tubal pregnancy, obliteration of the lumen is one of the most important, as they have had occasion to observe it in a large percentage of cases in which the permeability of the tube was tested chiefly after the method of passing fluid through the tube. The pathologico-anatomical data we have obtained however, show us a somewhat different picture for we have observed partial obliteration of the tube only in 4 cases of our total of 240, and of these 4 there were 3 cases

of tubal pregnancy. The contradiction between the data obtained by means of passing fluid through the tube and those of our pathologico-anatomical material apparently lies in the fact that the tubes and the uterus show a varying reaction to irritation at different phases of the menstrual and ovarian cycle—as may be seen from experiments carried out on animals by Kok, Martinoli, Dyroff and from our own experiments on removed human tubes, and the irritation is apt to produce a lasting spasm which may be readily taken for impermeability of the tube.

However since the publication of a number of Hoehne's papers the majority of authors attribute the inflammatory cause of tubal pregnancy to the adhesion of folds and adenomyosis of the tube termed since the publication of Martin's work *Salpingitis pseudofollicularis*. This point of view was prevalent for a number of years and the inflammatory theory as to the etiological cause of tubal pregnancy implied adenomyosis and adhesion of the tubal folds ('*Faltenverschmelzung*'). Within the last few years however the points of view on the nature of these conditions differ considerably for, though the older investigators (Hoehne, Opitz, A. Martin, Kossmann, Albrecht,

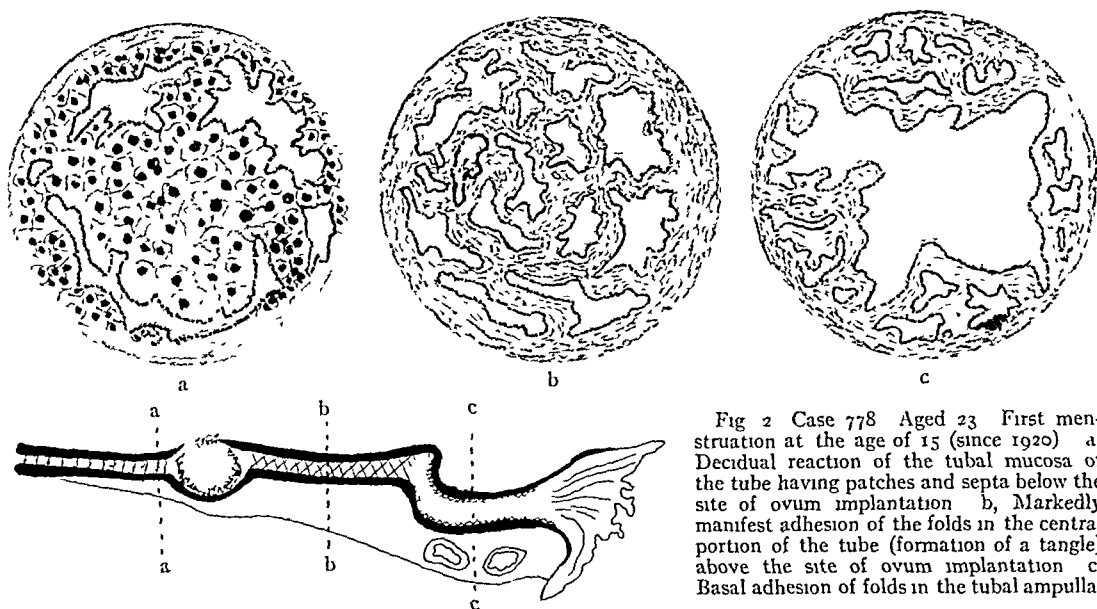


Fig 2 Case 778 Aged 23 First menstruation at the age of 15 (since 1920) a, Decidual reaction of the tubal mucosa of the tube having patches and septa below the site of ovum implantation b, Markedly manifest adhesion of the folds in the central portion of the tube (formation of a tangle) above the site of ovum implantation c, Basal adhesion of folds in the tubal ampulla

Ulezko-Stroganova, and a number of others) believe the formations to be of a purely inflammatory nature, the investigators of a later period (Schriddé-Schoenholz, Lahm, Pankow) consider that the process arises as the result of insufficient differentiation of the tube during the embryonic or postembryonic

period, and that consequently adenomyosis and the adhesion of folds occur as a result of defective development and are in no way connected with inflammation. Among our 100 cases of tubal pregnancy 21 were caused by the adhesion of folds, which is regarded by Hoehne as well as by the majority of subse-

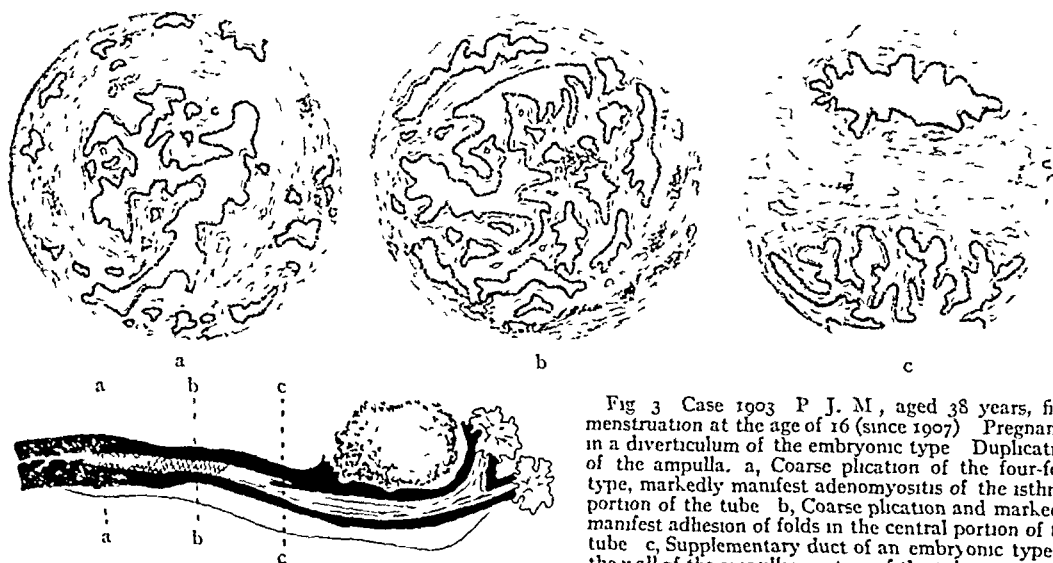


Fig 3 Case 1903 P. J. M., aged 38 years, first menstruation at the age of 16 (since 1907) Pregnancy in a diverticulum of the embryonic type. Duplication of the ampulla. a, Coarse plication of the four-fold type, markedly manifest adenomyosis of the isthmus portion of the tube b, Coarse plication and markedly manifest adhesion of folds in the central portion of the tube c, Supplementary duct of an embryonic type in the wall of the ampullar portion of the tube

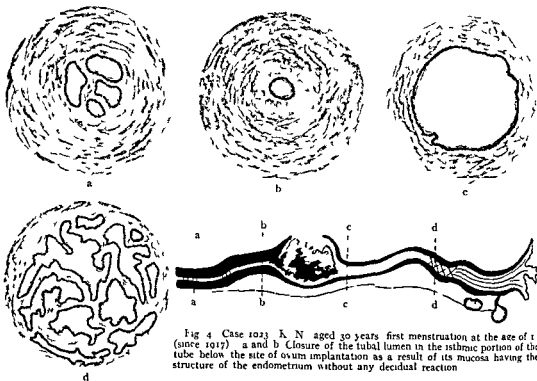


Fig 4 Case 1023 K N aged 30 years first menstruation at the age of 1 (since 1917) a and b Closure of the tubal lumen in the isthmic portion of the tube below the site of ovum implantation as a result of its mucosa having the structure of the endometrium without any decidual reaction

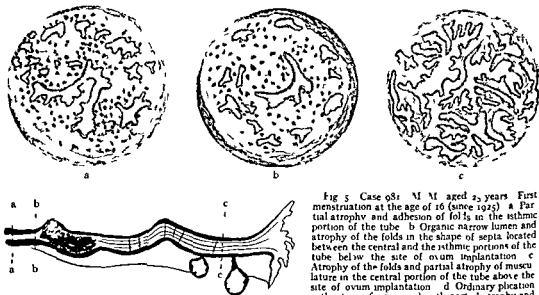


Fig 5 Case 981 M M aged 25 years First menstruation at the age of 16 (since 1925) a Partial atrophy and adhesion of folds in the isthmic portion of the tube b Organic narrow lumen and atrophy of the folds in the shape of septa located between the central and the isthmic portions of the tube below the site of ovum implantation c Atrophy of the folds and partial atrophy of musculature in the central portion of the tube above the site of ovum implantation d Ordinary plication without ramification and with partial atrophy and adhesion of folds in the tubal ampulla

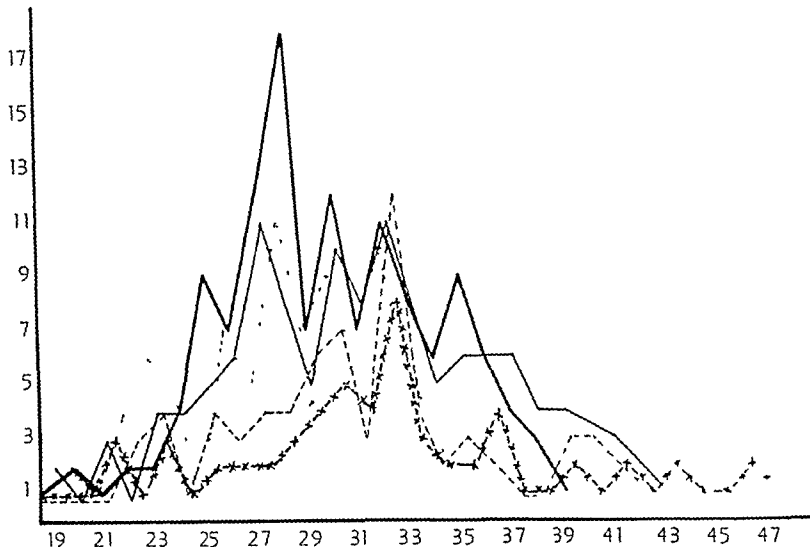


Fig 6 Diagram covering extra-uterine pregnancy percentages from 1920 through 1930 ----, 1920-1922, -x-x-, 1923-1924, . . . , 1925-1926, ———, 1927-1928, ————, 1929-1930

quent authors, as being identical to adenomyosis. Lahm was the first to consider adhesion of the folds independently of adenomyosis in discussing factors causing tubal implantation of the ovum. His belief that adhesion of the folds was caused by insufficient differentiation of the tubal mucous membrane during the postembryonic period, Lahm based on the works of Wendeler who had proved that in children the oviducts were rich in cytogenous stroma and that the latter disappeared by the time a girl reached puberty. Hence Lahm was led to conclude that in cases in which the cytogenous stroma did not disappear from the mucous membrane of the tube by the time of puberty, the mucosa of the tube was capable of menstruating. Thus, adhesion of the folds occurred as a result of tubal menstruation followed by desquamation. The works of Wendeler, Schridde-Schoenholz, Lahm, Schroder, Schottlander, N Meyer, Halban, etc. give us an idea of the origin of the two conditions, i.e. adhesion of the folds and adenomyosis, as well as of their independence of one to the other. Space does not permit here a detailed discussion of the origin and the nature of the two conditions. We must mention, however, that on the

ground of our own observations we fully support the point of view of Schridde-Schoenholz, and Lahm and believe that adhesion of the folds and adenomyosis are entirely independent conditions, which, however, frequently are associated with one another, as the essential cause of adhesion, i.e. insufficient differentiation of the mucous membrane of the tube is apparently a contributory factor in the development of adenomyosis. By no means can we agree with the theory that adhesion of the folds is caused by inflammation, for in our extensive series of cases (a total of 350 fallopian tubes), we have often observed in some cases adhesions of the folds but no trace of either an early or recent inflammation and in other cases folds having a regular fibrous stroma but devoid of scars, deformities, or superstructures. We have also often seen adherent folds in other tubes, as well as in the glandular ducts of embryonic origin, but these showed no greater traces of inflammation than did the main tube. In 60 of our cases we observed adhesion of the folds in tubal pregnancy — (60 per cent). When the tubes were examined in pairs the phenomenon was observed in both tubes, but not infrequently it differed in intensity, marked adherence sometimes

being manifest in the pregnant and some times in the non pregnant tube. In 20 cases we observed a mild form in the shape of basal adhesions of the folds and in 15 cases formation of bands and partitions. In 5 of the latter cases a decidual reaction in the partitions took the form of patches. We repeat once more that in the 16 cases of adherent folds observed by us we always found in patches, a decidual reaction of the tube, i.e. in 100 per cent of the cases. This apparently confirms the point of view that adhesion of the folds occurs in tubes with an insufficiently differentiated mucous membrane as a result of tubal menstruation and that the patches of cytogenous stroma which remain as a result of partial desquamation are capable of producing a decidual reaction in pregnancy independent of the site at which the ovum is implanted.

In 35 cases the mucous membrane of the tube resembled a coarsely or finely meshed sieve and in 2 cases it formed a tangle. Not infrequently it is possible to find in one and the same tube adhesion of the folds in the pars ampullaris and pars intermedia and both patches of decidual tissue and adenomyosis in its isthmus portion. In other cases adhesion of the folds may be observed within either one or several limited sections of the tube, while other segments of the same tube show a complete atrophy of folds which in one case was accompanied by atrophy of tubal musculature.

In all the cases in which further progress of the ovum was stopped because of the adhesion of folds, i.e. in 21 cases ampullar pregnancy was observed (Fig. 1). In 39 cases either adhesion of the folds was so slight that it could not have prevented the migration of the ovum or it was markedly manifest resembling a finely and coarsely meshed sieve but occurred above the site of implantation (5 cases), so that the ovum had already overcome the obstacle thus presented or the adhesion could have had no effect on its migration for it was located considerably below the site of implantation (the remaining 6 cases). The cases in which we have observed very evident adhesion of the folds above the site of oval implantation (2 cases of external migration of the ovum, 2 cases in which implantation was caused by decidual reaction in the partitions—

Fig. 2—and 1 case in which the cause has remained unknown)—all speak in favor of the fact that the ovum is not held in the tube because of the difference between its size and that of the orifice through which it has to pass, as was Hoehne's belief. This difference is but an added obstacle which requires increased power of transportation to ensure the passage of the ovum within the due period of time and only when such increased power of transportation is lacking the ovum either fails to overcome the obstacle or so far delays its passage that its capacity for implantation occurs before it has reached the end of its journey.

It is of interest to note that in all the 5 cases in which the ovum had already passed through the sieve the latter was always found in the central portion of the tube, i.e. in the pars intermedia while in the same cases adhesion in the ampulla was only slight. At the same time in the 21 cases in which the ovum had been caught in the meshes of the sieve we always observed an ampullar pregnancy. Apparently this is due to the fact that the presence of an obstacle fails to increase the transportation capacity of the ampullar portion of the tube, as the ampulla does not produce any peristaltic contractions and shows but a pendular motion (*Pendelbewegung*) as has been proved by the experiments of Kol and Mikulicz Radecki which have been carried out mostly on animals as well as by our observations on removed human tubes. Apparently the ovum passes the ampullar portion of the tube not because the latter is possessed of motor capacity—which might have grown more active with an increase in resistance but either because of a flow of fluid which occurs when the follicle bursts (Westmann, F. Putnin) or because of capillary motor activity which arises both on account of the activity of the vibratory epithelium (Hoehne, Mandl) and of the peristaltic contraction in the other sections of the tube (Skrobansky).

Thus transportation within the ampullar portion of the tube is quite insufficient and cannot be increased in accordance with growing resistance hence, even a small obstacle may cause delay or even stop further progress

of the ovum. On the other hand in the central section of the tube we have an additional factor the rôle of which seems to be predominant, i.e. the peristaltic contractions of the muscles of the tube, which may develop considerable strength and readily force the ovum through an orifice of even smaller diameter than its own.

We believe that defective development of the tube is another frequent factor causing tubal pregnancy and we consider it to have been the cause of the condition in 21 of our cases. In 7 of these the ovum was implanted in an accessory duct of embryonic origin, and the subject has been discussed in detail in our previous work (Fig 3). In 1 case tubal pregnancy had been caused by defective development of the mucous membrane in the isthmic portion of the tube which in its structure resembled the mucous membrane of the uterus (Fig 4). Though in this latter case no typical decidual reaction was observed to occur in the tube (such as we have seen in 5 other cases), yet there were certain premenstrual (pregnandic) changes of the mucosa and in connection with the lumen of the tube which was of small diameter and proved sufficient to hold the ovum. In another 8 cases in which the mucous membrane was of the four-fold type and was characterized by partial atrophy of the folds, implantation of the ovum occurred between the folds. In 3 cases there was complete atrophy of the folds in the tube and the lumen was of excessively small diameter (Fig 5). In the 2 remaining cases partial atrophy of tubal musculature was observed.

Many authors believe that defects of tubal development are one of the principal factors in causing tubal pregnancy (F. Grisser, Grossier, Freund, Okintchiz), but as a rule they do not discuss in detail or even point out the direct cause responsible for the settling of the ovum in the tube. Lahm, however, in his work published in 1928 shows by excellent illustrations implantation of the ovum between the folds in the fourfold type of mucous structure and partial atrophy of the folds, in atrophy of musculature and in various types of adhesion of the folds. Therefore, we advise those who wish to become better acquainted with the subject to study his work, as our

cases reveal a similar picture. However, Lahm does not mention pregnancy in the accessory ducts of embryonic origin, which we have reported in detail in our previous work and which has also been mentioned by Schoenholz.

In the 3 remaining cases tubal pregnancy was due to tumors which produced displacement of the tube and interfered with its regular contraction. In 2 cases it was fibromyoma of the tubal angle of the uterus, in 1 case fibromyoma of the round ligament.

Thus, on the basis of our series of 100 cases of tubal pregnancy, we believe that the causes are as follows: inflammation in 14 per cent of cases; adenomyosis, in 19 per cent; defects of development, in 21 per cent; decidua, in 8 per cent; adhesion of folds, in 21 per cent, and tumors, in 3 per cent—a total of 76 per cent in which the etiological cause was the third factor. In 10 per cent, cases in which there was external migration of the ovum, tubal pregnancy was due to the first factor and only the 14 per cent remaining were caused by the second factor, i.e., transportation of the ovum. The first impression produced by these figures is that mechanical causes play an important rôle in the etiology of tubal pregnancy. Fallopian tubes are an organ which closely resembles the uterus both in structure and origin, and it is generally known that the uterus is usually the more active the greater the resistance. Hence, it seems that mechanical obstacles could hardly interfere with the progress of the ovum provided the motor activity of the tube is normal. The fact that the vast majority of the patients had several normal pregnancies previous to the given tubal pregnancy also speaks in favor of the latter consideration. Consequently, the mere presence of a mechanical obstacle is not enough to cause tubal pregnancy, but must be connected with deficiencies in its transportation. Apparently disturbances in motor capacity are dependent on the activity of the vegetative nervous system. Various emotions such as fear of pregnancy, abortions, the administration of contraceptive measures (Skrobansky) may lead to waves of antiperistaltic contractions. These latter may cause no harm in a normal tube but, because the ovum

deviates from its normal course, may result in pregnancy in deformed tubes, or may cause considerable delay in its progress. Therefore, we believe that in the etiology of tubal pregnancy the role of the third factor (mechanical obstacles) as well as that of the first factor (the ovum developing its capacity for implantation before it should), is by no means absolute, for if transportation, which does not merely depend on good musculature but mainly on innervation and hormonal influences, is perfect the ovum may reach the end of its way in spite of the obstacle. In our experiments we have observed the progress of foreign bodies (poppy seeds) placed in the ampulla of the tube which reached the isthmus portion of the tube within from 3 to 5 hours. Yet the importance of mechanical obstacles is relatively great, as slight disturbances in transportation which may remain unnoticeable in normal tubes will result in tubal pregnancy in deformed tubes.

In studying the mechanical factors causing tubal pregnancy we have observed one that was of very frequent occurrence, i.e. defective development of the tube. We believe that of the 100 cases we have observed defective development of the tube was the etiological factor in 29 cases, including the 8 cases characterized by decidual reaction, strictly speaking, however, the group should also include such cases as shown adhesion of the folds which arises from insufficient differentiation of the tubal mucous membrane. The total number of cases then would be 50 per cent, even if we omitted cases of adenomyosis in spite of the fact that it is closely connected with defective development of the tube. Defective development of the tube, which is of embryonic origin, apparently shows very stable figures and, besides, its rôle in the etiology of tubal pregnancy, is very insignificant (6 per cent in our series). Postembryonic defects however which occur during puberty, apparently may arise from external influences (hard living conditions, infectious diseases at this age), consequently, protection of a woman's health at that period may considerably lower the percentage of extra uterine pregnancy.

It is possible that this factor may have caused an increase of extra uterine pregnancy percentages in 1928 because the patients

mainly consisted of young women who had reached puberty between 1914-1921 as may be seen from the diagram embracing 10 years from 1920 to 1931 (Fig. 6). The diagram shows that the maximum number of patients suffering from extra uterine pregnancy within the period of 1925-1924 were aged 32, an age at which all medical men believe women to be most liable to develop extra uterine pregnancy. Between 1925-1926 we see a slight shift to the left comprising women of a younger age, i.e. 3 almost equal waves at the age of 27, 30 and 32. In 1927-1928 the rise at the age of 27 is even more marked, while during the period 1929-1931 there is another shift to the right with 3 almost equal waves for the ages of 27, 30, and 32. This shift to the younger age of 27 instead of the usual age of 32 during the years 1927-1928 has been noted by many authors both in our country (Krivky) and abroad (Apoylanti and others). Apparently the harder conditions of life which were brought about by the imperialist war had something to do with the figures.

✓ SUMMARY

1 The etiology of tubal pregnancy may depend on 3 factors: (1) the ovum developing its capacity for implantation before time, i.e. before it reaches the uterus, (2) disturbed transportation of the ovum, (3) mechanical obstacles encountered by the ovum on its journey.

2 All three factors are closely connected with one another and therefore their distinction of one from another can be only approximate. However, the outstanding cause apparently is the second factor, i.e. disturbed transportation of the ovum, for in all probability it may be the independent cause of tubal pregnancy, while the first and third factors in particular (i.e. mechanical obstacles) play merely a relative part and must be accompanied by disturbed transportation however slight to cause tubal pregnancy.

3 The motor capacity of the tube depends to a great extent on the effect of the vegetative nervous system, which in its turn may be influenced by various emotions: fear of pregnancy, abortion, and the administration of contraceptive measures.

4 From a study of the 100 cases of tubal pregnancy in this series we believe that the cause of the implantation was the first factor (1 e, external migration of the ovum) in 10 per cent of cases, the second (1 e, disturbed transportation) in 16 per cent of cases, and the third (1 e, mechanical obstacles) in 76 per cent.

5 Among the mechanical causes, defective development of the tube of postembryonic nature seems to be of prevailing importance

6 Improvement of the living conditions, less frequent occurrence of infectious diseases, and better working conditions for growing girls will reduce the percentage of extra-uterine pregnancies.

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CLINICAL SURGERY

FROM THE SURGICAL CLINIC OF THE PETER BENT BRIGHAM HOSPITAL

SURGERY OF THE STOMACH AND DUODENUM

Procedures for Peptic Ulcer and Gastric Cancer

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THE field for gastric surgery has become more confined at the same time that the procedures have assumed a greater magnitude. Surgery, with its increasing tendency to more extensive resection, is universally accepted as the appropriate treatment for gastric cancer. A similar radical attitude toward subtotal gastrectomy as the optimum procedure in many cases of peptic ulcer has become firmly established. Instead of the uniform utilization of gastro-enterostomy or plastic procedures at the pylorus. It is our purpose to describe in detail and to illustrate the more commonly used surgical procedures in this field.

It cannot be too strongly emphasized in the surgical management of peptic ulcer that a routine gastro-enterostomy or any routine resection should not be applied to every case. The various operations advocated indicate the weakness of any particular type. Except for gastric neoplasm and free perforation of an ulcer, gastric surgery should not be contemplated unless the case has been thoroughly analyzed and enough information obtained to plan an operation suitable to the individual patient. Before operation the surgeon should have the following data:

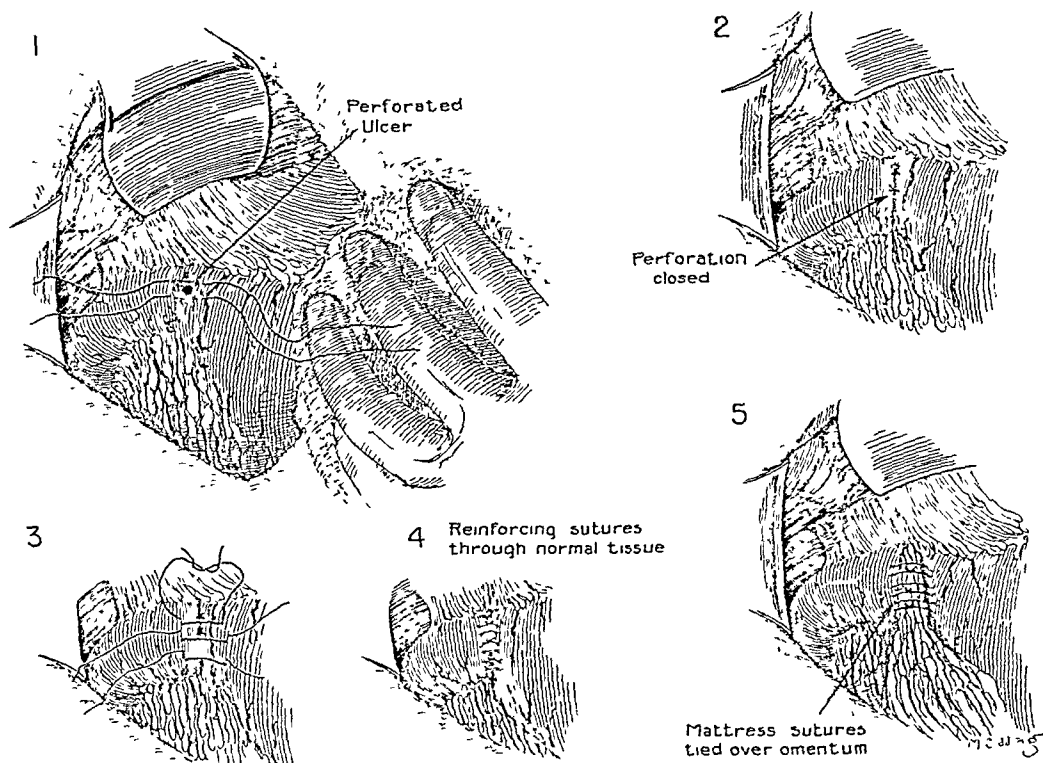
1. Amount and quality of medical treatment
2. Location of the lesion
3. Degree and amount of gastric acidity
4. Degree and duration of obstruction
5. Incidence and source of hemorrhage
6. Any previous surgery

He must know not only how long the patient has had medical treatment but the quality of such treatment. Surgery should never be considered if the patient has had only casual medical treatment. Every patient should have the benefit of a trial of well established "adequate medical regime."

The surgeon should be influenced by the location of the lesion because of the frequency of malignancy in certain areas. Gastric ulcers within one inch of the pylorus should be considered malignant and early surgery advised regardless of the age of the patient. Findings by gastric analysis or apparent early improvement clinically and by x-ray. If lesions in this location are not resected the patient should be subjected to frequent rigid examinations for an indefinite period. Likewise ulcerations on the greater curvature or very large ulcerations should be considered malignant and resection advised.

The degree and amount of gastric acidity is too frequently disregarded by the surgeon. We believe these factors are of fundamental importance. The diagnosis and management of hypersecretion have been emphasized by Emery. Short circuiting procedures (gastro-enterostomy) and even small resections (pylorotomy) in the presence of high acid values (hyperacidity) or excessive amounts of gastric secretion (hypersecretion) not only fail to 'cure' these patients but leave them likely candidates for more serious complications such as jejunal ulcer, gastrocolic fistula, etc. We believe that removal of the antrum is not sufficient in these cases and removal of a large amount of the acid bearing tissue is absolutely essential. The surgeon, by removing a very large amount of the acid bearing tissue, may not be able to lower the acid values as shown by gastric analysis months after the resection, but there results a considerable decrease in the total volume of acid secreted which protects the patient from recurrent ulceration.

Immediate surgery should not be advised even if the patient's symptoms and x-ray findings indicate complete pyloric obstruction. Remarkable improvement and frequent avoidance of surgery



Figs 1 to 5 Closure of perforation Subphrenic abscess

may follow gastric lavage, nightly aspirations, bed rest, and strict medical management. We do not advise surgery until this has been tried for a period of time and the roentgenologist repeatedly finds a gastric retention of 40 per cent or above. Gastro-enterostomy may then be the operation of choice in such instances except in young patients with a tendency to high acid values or when there is a suspicion or definite evidence of hypersecretion.

The problem of surgery in the treatment of hemorrhage is far from settled. The statistics of Emery and Monroe indicate that surgical procedures in the treatment of hemorrhage are probably no more satisfactory than exacting medical treatment. We do believe that surgery may be indicated in the case of hypersecretion associated with hemorrhage and perhaps in certain patients with repeated, or one massive, hemorrhage from a posterior penetrating duodenal ulcer.

If there has been a previous surgical procedure, the surgeon should study the records of this previous operation as well as the x-ray evidence. Jejunal ulcers or any other complication following

gastro-enterostomy should be treated by extensive resection. It is a mistake to "take down" a gastro-enterostomy after ulceration or a gastro-jejunal colic fistula and restore the structures to normal continuity. The tendency for the original ulceration to recur is great. Such patients are frequently in the hypersecretion group and require the removal of a large amount of acid-bearing tissue.

Exploration should not be denied any patient with gastric neoplasm unless there is ample evidence of widespread metastasis. In some patients exploration will frequently demonstrate a removable neoplasm although from the duration of symptoms, the x-ray findings, and the physical examination the situation seemed hopeless. In others gastro-enterostomy may offer a more comfortable terminal existence.

CLOSURE OF PERFORATION (FIGS 1-5)

Pre-operative preparation. Perforation requires immediate surgery. The operation is delayed only if the patient has not recovered from the initial shock of the perforation or in the late case when

the fluid balance must be established before any type of procedure can be attempted. Morphine should be used liberally to control pain after the diagnosis is established and constant gastric suction should be instituted and maintained throughout the anesthesia and the early days of the postoperative period (3).

Anesthesia General anesthesia is desired because of the severe pain and in order to overcome the marked *muscle spasm* which results from the chemical irritation of the peritoneum. Local anesthesia may be substituted as the anesthesia of choice in the poor risk patient or in the presence of respiratory infection.

Position The table should be flat with the patient's feet slightly lower than the head. This position assists in lowering the field below the costal margins and keeps gastric leakage away from the subphrenic area.

Incision Since the majority of perforations occur in the anterior superior surface of the first portion of the duodenum, they are easily exposed through a small high right rectus incision. The margins of the wound are carefully protected by moist gauze pads. If the diagnosis is uncertain, the wound may be filled with saline to verify the escape of air when the peritoneum is opened. A culture of the peritoneal fluid is taken and as much exudate as possible is removed by suction. Retractors are inserted to expose the field one retracting the liver upward. This gives adequate exposure of the frequent sites of perforation. When the perforation has been present several hours the field will usually be found walled off by the agglutination of intestines and the omentum and care must be exercised in approaching the perforation that unnecessary soiling of the field be avoided. It is wise to expose only the seat of the disease and in so far as possible to remain within the fixed field "walled off" by nature's own process.

Details of procedure The opening is closed by several silk or catgut mattress sutures (Fig. 1). These are placed just beyond the area of maximum induration and are tied very gently to prevent laceration of the friable tissue (Fig. 2). Additional mattress sutures which include tissue beyond the area of induration are placed to plicate flexible intestinal wall over the perforated area (3). This does not necessarily occlude the pylorus as one might expect (Fig. 4). The site of perforation may be further sealed off with omentum as shown in Figure 5, preferably after its closure with sutures, as shown in Figure 1. If this method of reinforcement is to be employed, the greatest caution should be exercised to tie the mattress

sutures very loosely over the omentum to prevent interference with its blood supply. We believe that the addition of a gastro-enterostomy to the simple plication of a perforated ulcer adds considerably to the mortality rate. Moreover the necessity for this procedure has been largely overcome by the use of constant gastric suction during the postoperative period. All exudate and fluid is removed by suction, and the wound is closed without drainage. In perforations of over 6 hours duration the institution of drainage may be considered. Because of the danger of wound infection it is advisable to use retention sutures in addition to the usual closure.

Postoperative care The patient is placed in Fowler's position when conscious. Constant gastric suction is continued until there is reasonable assurance that the pylorus is no longer occluded by edema. The fluid balance is maintained by the intravenous and subcutaneous route. If the patient demands sips of water this should be allowed from the beginning. After 3 to 4 days the patient is started on a strict medical régime. It should be remembered that a subphrenic abscess may occur as a complication during the postoperative period. Finally, these patients must be continued on strict medical management for an indefinite period because simple closure of the perforation has not cured the patient of his ulcer or his tendency to reform another.

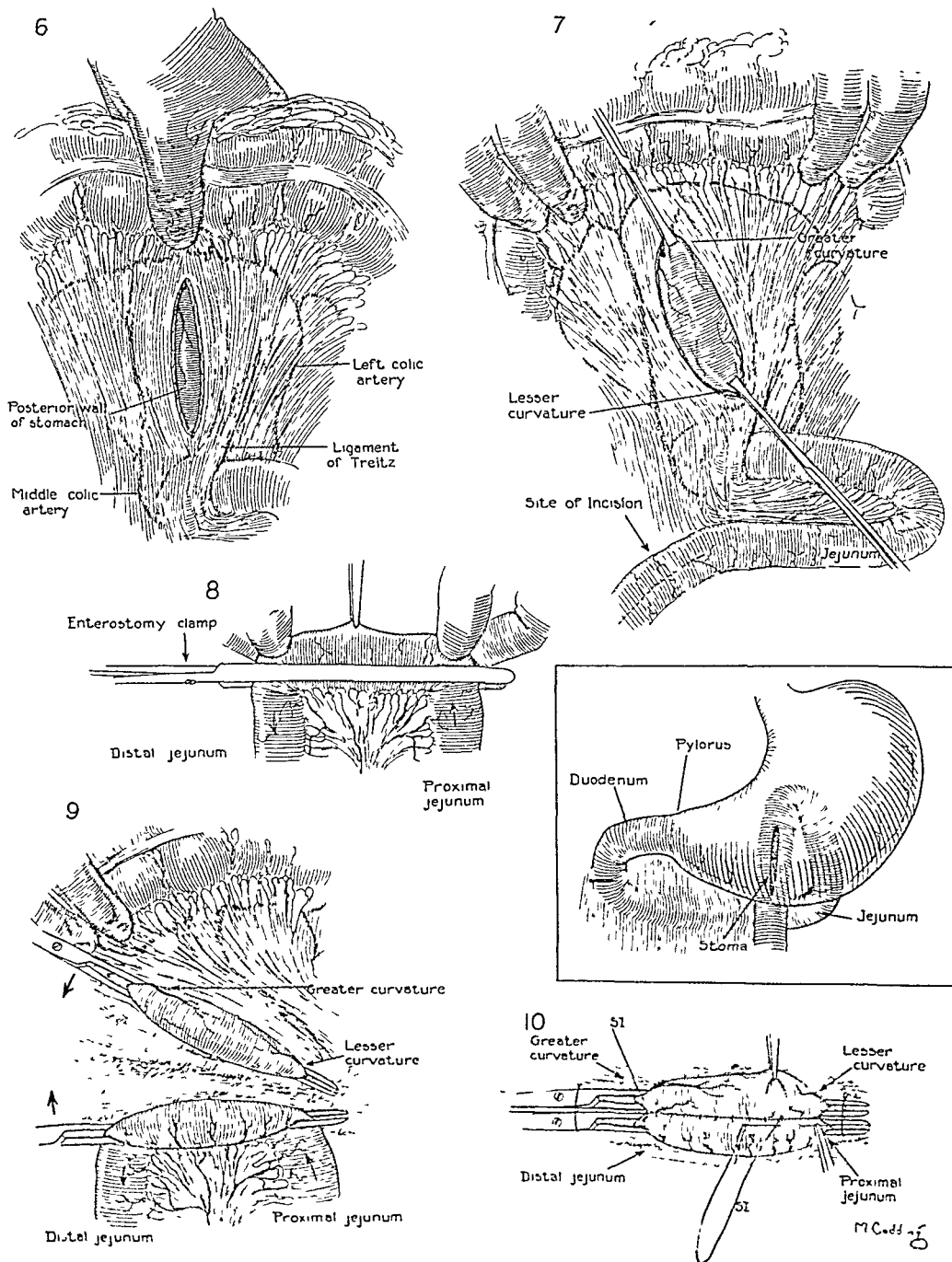
GASTRO-ENTEROSTOMY (FIGS. 6-11)

Pre-operative preparation The specific preparation for this operation relates to emptying the stomach by gastric lavage. This is usually done the night preceding operation to make certain that all coarse particles of food have been removed and that gastric tension has been relieved. The lavage is repeated 1 to 2 hours before operation.

Anesthesia The operation itself presents no special anesthetic contraindications and the choice of anesthesia will depend upon the general condition of the patient and the custom of the surgeon.

Position A flat table with the patient's feet at least a foot lower than the head will be found advantageous. In patients with an unusually high stomach an even more upright position may be of assistance. Once the abdomen is opened and the position of the stomach is determined, the optimum position can be adjusted.

Incision and exposure As a rule a midline epigastric incision is satisfactory. If one is certain that gastro-enterostomy alone is to be performed it may be wise to use a left paramedian incision opening the left rectus sheath about 1 inch mesial



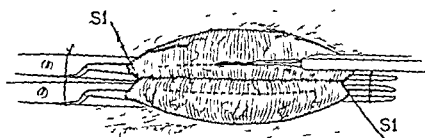
Figs 6 to 10 Gastrojejunostomy

to the midline, which permits closure with two fascial layers. As a rule the incision should extend up to the xiphoid if in the midline or to the costal margin if a paramedian incision, and all most to the umbilicus inferiorly.

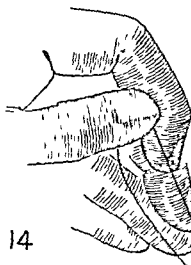
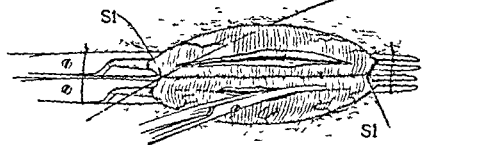
Details of procedure With the abdomen opened, a self retaining retractor may be utilized though, since most of the structures involved in this operation are mobile it is quite unnecessary to use any great amount of traction for adequate exposure. The stomach and duodenum are first visualized and then palpated to determine the type and extent of pathology present. If gastro-enterostomy is decided upon a point is selected at about the junction of the middle and lower thirds of the stomach opposite which in the posterior surface the opening in the stomach is best placed. The omentum of the large bowel is then reflected upward over the stomach, and the posterior aspect of the colonic mesentery is visualized (Fig. 6). Pressure on the anterior wall of the stomach at the point previously selected presents a bulge in the mesentery of the colon at the point where the stomach should be drawn through the mesentery. The mesentery is carefully incised at this point care being used to avoid the larger vessels in the mesentery of the colon and preferably to the left of the middle colic vessel and rather near the ligament of Treitz. The upper and lower borders of the stomach are then seized in Allis forceps (Fig. 7), the forceps on the greater curvature being swung toward the operator who should be on the right hand side of the patient, while the forceps on the lesser curvature is swung to a position opposite the first assistant. The ligament of Treitz is then identified, and a fairly long loop of jejunum is brought into the wound. As a rule the anastomotic opening of the jejunum should be 8 to 10 inches from the ligament of Treitz. The jejunum at this point is then held up with the fingers of the operator and his first assistant while the operator applies the enterostomy clamp (Fig. 8). In our opinion clamps with a spring are best used without rubber covers. The covering with rubber renders them bulky and also makes them so slippery that one is apt to use more pressure especially at either end of the clamp than is necessary. If the clamp is of a fine spring steel it will hold its position well without great pressure and far better without rubber than with it and in our experience, we have never seen any deleterious results from using uncovered clamps. The first assistant aids in adjusting the exact place for this clamp by lifting the fragment of the jejunum between the two fingers with a smooth forceps. The clamp is applied just distal to the mesenteric border. With

this applied a piece of gauze is laid next to the jejunum (Fig. 9), then the stomach is seized in a similar clamp and the Allis forceps are removed from the stomach wall which they may lacerate. The clamp on the stomach seizes a fragment of the gastric wall that runs obliquely down from lesser to greater curvature (see diagram). Now the two enterostomy clamps are brought side to side and held there by ligature material or rubber bands (Figs. 9 and 10). The clamps are adjusted so that the distal end of the jejunal opening will be at the greater curvature of the stomach. The large intestine is now returned within the abdomen above the stomach and the field of operation is brought outside the peritoneal cavity and entirely protected with gauze from possible contamination. Retraction of the edges of the abdominal wound is discontinued while the anastomosis is being performed. The serosal layer (Fig. 10, S₁) is now commenced the surgeon placing a mattress stitch which holds the bowels together on the side toward the operator, using a simple Cushing stitch. The free end of the suture S₁ is left long in order that it may be tied to the opposite end of the suture S₁ at the completion of the anterior serosal layer. The surgeon picks up alternate bites of jejunum and stomach taking care that the suture does not enter the lumen of the bowel, and carries this continuous suture for a distance of a full 2 inches. Here the suture is again tied, the remainder of the suture being left for closing the anterior serosal border after the stomach and jejunum have been opened and closed with the mucosal suture. When this first serosal stitch has been completed, fresh moist toweling should be laid on both sides of the field and only those instruments should be left on this toweling which are to be used for opening the stomach and jejunum, for cleaning the lumens of these structures when they are opened and for closing the bowel with the mucosal suture. In so far as possible only the operator and his first assistant should indulge in these technical steps in order to avoid unnecessary soiling of the field. Figures 11, 12 and 13 illustrate the method of opening the viscera. Small incisions in the stomach and jejunum are first made with a scalpel. Through these the contents of the gut are wiped out with a small piece of gauze moist with saline solution and the incisions are then made of adequate length with a pair of scissors. In making these incisions the operator should be careful that he cuts the wall of the bowel perpendicularly to its circumference (Fig. 11). There is always a tendency to slit into the intestine obliquely thereby leaving an irregular and unequalized

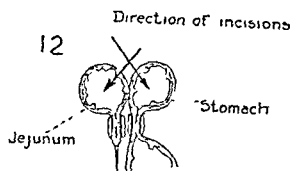
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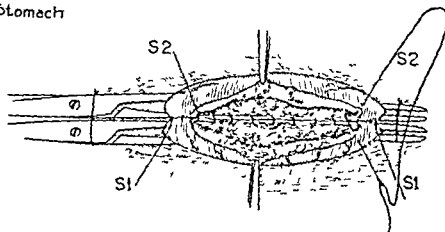
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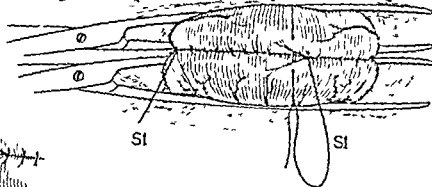
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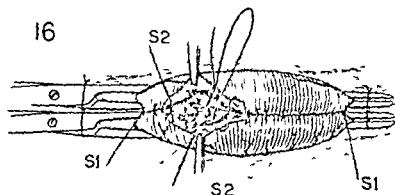
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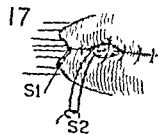
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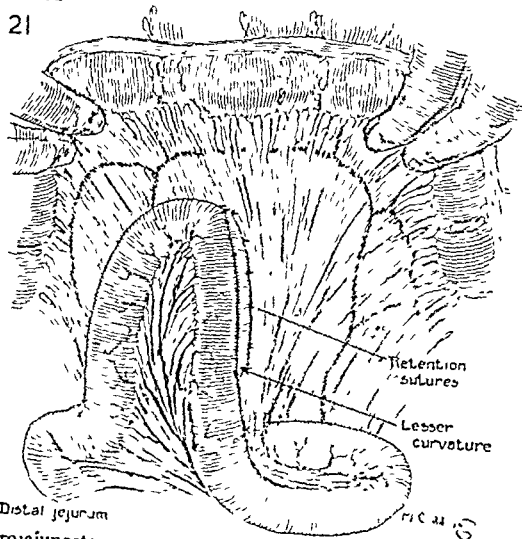
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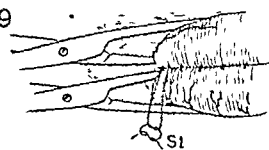
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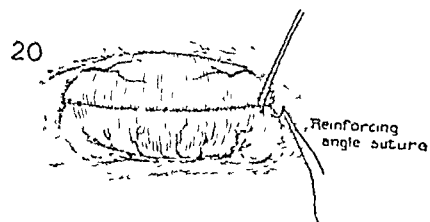
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20



Figs 11 to 21 Gastrojejunostomy, continued.

mucosal layer for the next suture line. With the stomach and intestine opened and cleaned, a new continuous suture is prepared (S₂). Beginning on the side toward the operator he approximates the two fragments in the angle of the wound, placing his first stitch if possible, a little above the free angle so that the final knot after completing the closure may be visualized as it is tied. As the operator sews away from him, he uses a simple over and over suture (Fig. 14) which pulls the mucosal cut edges together. From time to time the suture may be locked and it should be remembered that this suture is also used to control the blood supply. It must be kept under a tension which approximates well and will prevent hemorrhage from the approximated areas but not so tight that it will cut through later or completely shut off the blood supply and thus prevent healing. This is a critical step and the amount of tension is best adjusted by the surgeon holding the suture in his left hand as he sews with his right hand. The first assistant exposes the point to be sutured and pulls through the needle. When the operator reaches the further angle of the wound (Fig. 15) he had best resort to the Connell suture which allows him to invert the structures as he sews. In Figure 15 for example, the needle has just entered the jejunal side. It should next go out of the jejunal side 2 or 3 millimeters away from where it entered. It will then cross over into the gastric side and then again leave the gastric side before it crosses to the jejunal side. In Figures 16 and 17 one sees the final steps of the closure of the mucosal layer. As one gradually approaches the knot S₂ where this suture commenced the needle enters the lumen, and the suture is tied to the long end left after tying the first knot, thus closing the mucosal layer and leaving the knot on the inside. The clamps can then be released to see if there is any bleeding at any point. If necessary because of a little oozing somewhere an extra suture may be taken to supplement the original mucosal layer. Some prefer to do the anastomosis without clamps and tie each individual bleeding point before approximating the mucosa. When everything seems satisfactory the special toweling laid out for the preceding stage of the operation is discarded with the instruments which have been used, gloved hands washed off in an antiseptic solution and then the serosal suture which had been covered is picked up on the side toward the first assistant and the stomach and intestine approximated by an over and over Lembert suture, this suture being tied to the long end left at the commencement of this suture (Fig. 19). Figure 20 shows the placement of

additional sutures at the angles of the stoma so that any strain at this point may avoid the actual suture layer and be exerted on the additional serosal sutures where it can result in no harm. Figure 21 shows the last step which consists in anchoring the stomach, adjacent to the anastomosis to the mesocolon in order to close this opening and thus prevent future herniation through it.

Postoperative care. This will vary depending upon the pathology involved. Water in sips may be given within 24 hours and the fluid intake increased rapidly thereafter. The patient with ulcer is returned to medical supervision.

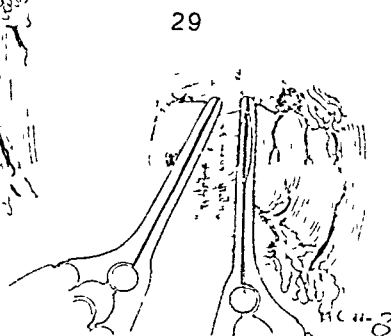
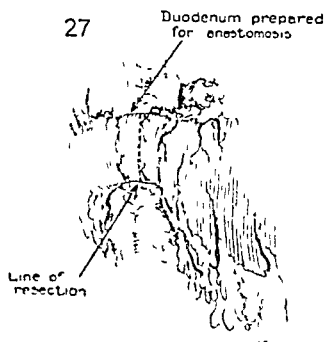
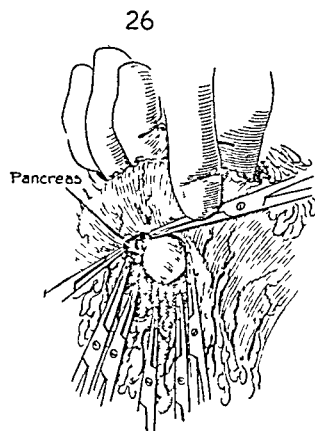
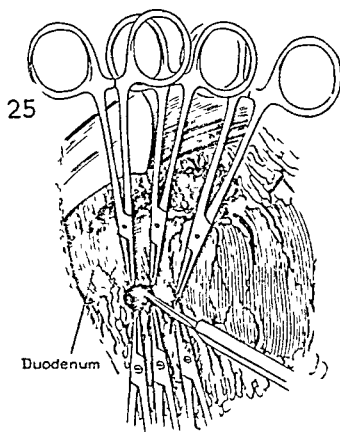
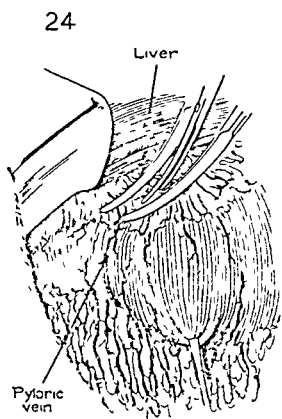
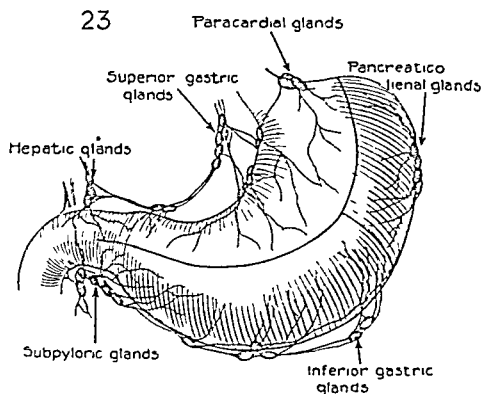
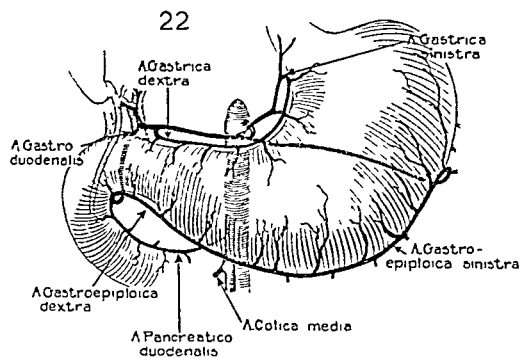
SUBTOTAL GASTRECTOMY (FIGS. 22-35)

Pre operative preparation. This will be largely directed by the findings from the analysis of the data listed in the second paragraph of this article. The nutrition of the patient and the amount of pyloric obstruction will dictate special pre operative preparation. Gastric lavage should be done the night preceding and the morning of operation when there is any degree of pyloric obstruction. The fluid balance must be established in the case of obstruction by suitable intravenous therapy (i.e., 5 per cent isotonic sugar solution in normal saline). Once surgery has been definitely planned, we have encouraged the patient to substitute a high caloric diet for the rigid ulcer regime to prepare for the postoperative period of limited caloric intake. The increased incidence of pulmonary complications associated with upper abdominal surgery makes it imperative that elective gastric operations be carried out in the absence of respiratory infections. Donors should be available for transfusion in case of pre operative hemorrhage, definite secondary anemia or when an extensive ordeal is anticipated in the removal of gastric neoplasm.

Anesthesia. This depends upon the patient's condition. Local anesthesia (novocain 1 per cent) is very satisfactory and in feeble and cachectic patients may be the anesthetic of choice.

Position. This is determined by the size of the stomach and its relation to the anterior abdominal wall. As a rule the table should be flat and the patient's feet at least one foot lower than the head but if the stomach is high a more erect position of the table is indicated.

Incision and exposure. A midline incision from xiphoid to umbilicus is satisfactory. Some surgeons prefer the paramedian incision which enters the rectus sheath just laterally to the midline. Such a paramedian incision may be to the right or left of the midline but is preferable to the right



Figs 22 to 29 Subtotal gastrectomy

since the most difficult part of the procedure is the proper mobilization of the duodenal stump. All of these incisions will give adequate exposure without great traction. A self retaining retractor may be utilized, but if not a broad bladed, fairly deep retractor placed against the liver and reaching down to the gastrohepatic ligament is a chief aid in adequate exposure.

Details of procedure Figure 22 depicts the arterial blood supply, and the surgeon should focus his attention on the pancreaticoduodenal branch of the gastroduodenal artery since this is the vessel which, in adherent tumor or ulcer is more frequently the source of the large gastric hemorrhage, and the vessel most likely to be injured without proper exposure during the surgical procedure. Figure 23 locates the major lymphatic gland group. Immediately upon exposure, if the operation is undertaken for tumor, the extent of glandular involvement should be noted, as well as possible metastases to the liver and pelvis, since upon the extent of the disease may depend the decision of the surgeon as to whether gastrectomy is desirable or not. If there be widespread glandular involvement and impending pyloric obstruction the surgeon is wise who refrains from the ordeal of gastrectomy and carries out the simple procedure of gastroenterostomy. Figures 24, 25 and 26 depict the freeing of the pylorus and the upper portion of the duodenum from its attachments. This is the most difficult step in the operation and one cannot state beforehand whether the attack should be begun at the upper or lower borders of the duodenum. As a rule the surgeon can break through the gastrohepatic ligament at the pylorus and work down until he reaches the area of the common duct and its associated major vessels. A similar clearing of the lower border of the duodenum from the pylorus distally is then carried out, the surgeon preferably keeping close to the duodenum and avoiding injury to the pancreas. Particular care must be given to the pancreaticoduodenal artery. This clearing of the lower border of the duodenum will soon permit the surgeon to pass beneath the duodenum and connect his free fields on both upper and lower borders so that the duodenum may be lifted away from the pancreas thus greatly facilitating further dissection. Having freed the pylorus and upper 2 centimeters of the duodenum or even further down the duodenum if it is involved in the lesion a piece of gauze wet in salt solution is passed beneath the structures (Fig. 27) and a pair of Payr clamps are placed just below the pylorus and the lesion (Fig. 28) and the duodenum is cut across (Fig. 29). If there be no free

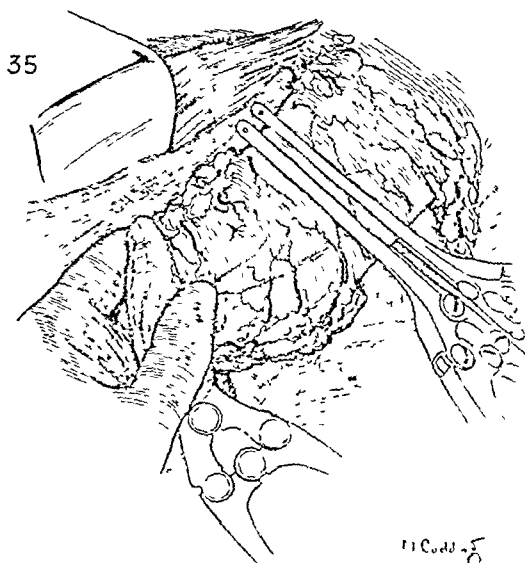
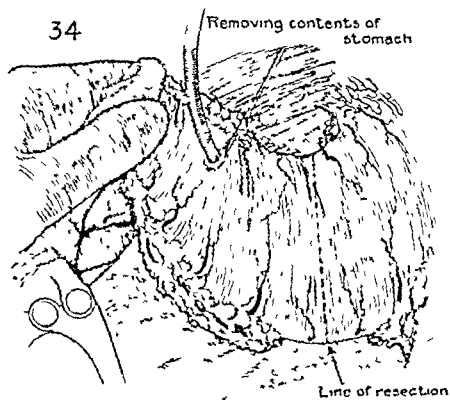
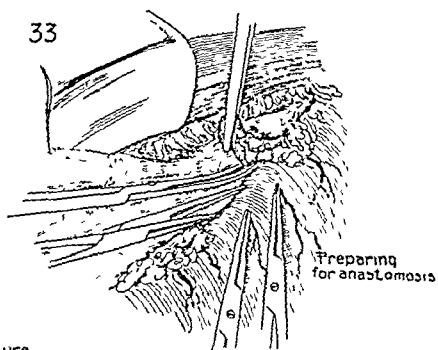
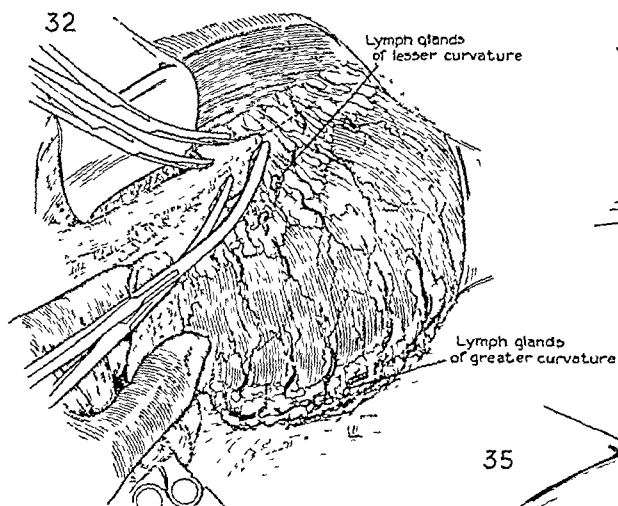
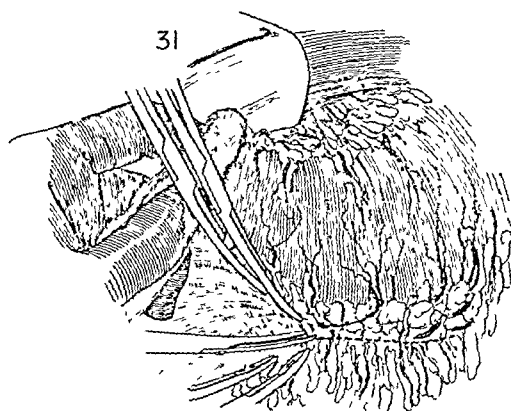
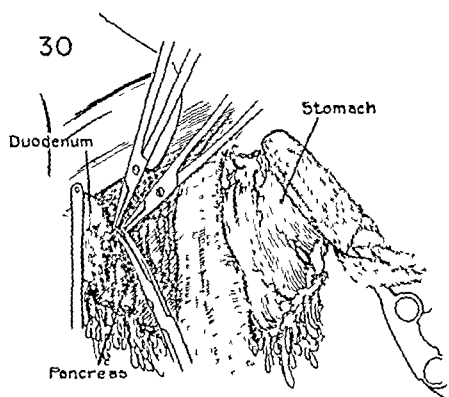
hydrochloric acid in the stomach contents it is preferable to do this with a cautery, although a scalpel may be used in the presence of free hydrochloric acid in the stomach since the gastric secretion under this condition is invariably sterile.

Figure 30 illustrates the further exposure of the posterior surface of the duodenum. It is wise to have at least 1 centimeter of the duodenum distal to the clamp freed from the pancreas in order that the subsequent sutures may be placed under full vision. While cleaning off the posterior surface of the duodenum the clamp on the gastric end is kept covered by a gauze wrung out in normal salt solution. Having freed the duodenum, the clamp holding it is covered with a similar moist saline sponge. All bleeding points are tied and a further liberation of the stomach is carried out (Figs. 31, 32 and 33). Either the greater or lesser curvature is dissected first, according to which seems most convenient. The most important factor here is to be sure that all of the glands which are visible on both greater and lesser curvature be left attached to the fragment of stomach to be removed. In Figure 33 is depicted the step of carefully freeing the lesser curvature of the attached fat and its mesentery at the point where the stomach is to be cut across. The operator will note that the vessel which runs in the lesser curvature mesentery divides sending paired branches to either side of the curvature at which point these vessels enter the gastric wall. These branches should be clamped and tied at the gastric wall and not left with a large amount of fat attached to them since adequate exposure at the curvatures is essential to a safe anastomosis. Figure 34 represents the rare occurrence where it seems wise to aspirate either through a trocar or by a catheter any unusual amount of gastric contents. Figure 35 represents the placement of paired Payr clamps well above the lesion and where lesser and greater curvatures have been carefully cleaned. We have deliberately exaggerated the distance of such freed areas at the curvatures in Figure 35 to emphasize the importance of this step.

By this stage of the operation the surgeon will have decided what type of repair to perform after the resection has been completed and the subsequent illustrations describe the Billroth I, the Billroth II and the Polya methods of repair.

BILLOT II REPAIR (FIGS. 36-47)

The schematic drawing illustrates the desired result in this procedure which is the reapproximation of duodenum and the remaining stomach. The chief consideration in the reapproximation is that



Figs 30 to 35 Subtotal gastrectomy, continued

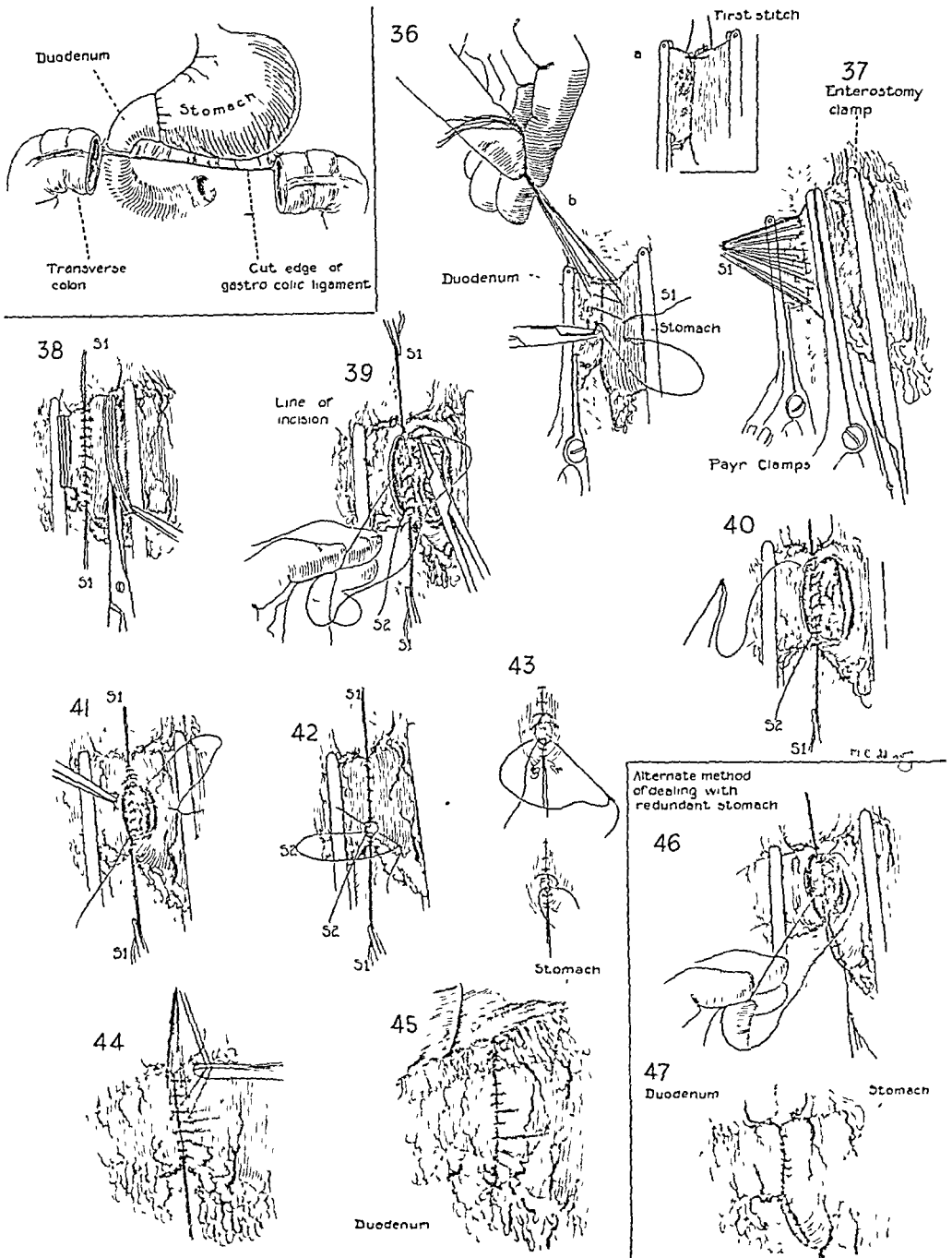
the duodenum be applied primarily to the lesser curvature border of the stomach which contains the "magenstrasse." The major line of force propelling the gastric contents onward proceeds along the lesser curvature and if an attempt is made to close this and arrange the duodenal opening elsewhere great pressure will be exerted where the "magenstrasse" is closed which may result in a breaking down of the suture line.

The decision to utilize the Billroth I type of repair depends upon the mobility of the upper and lower segments and whether they can be brought together without undue tension. Figure 36a depicts the first serosal stitch at the upper border of the two fragments of stomach and duodenum, and Figure 36b the subsequent placing of interrupted mattress sutures. Each suture in the stomach takes a little larger bite and is spaced a little bit farther from its neighboring sutures as compared with the corresponding suture in the duodenum. Thus the small duodenal fragment can be fitted to the larger gastric fragment. When these sutures are in place (Fig. 37), enterostomy clamps as seen in Figure 38 are placed on both duodenum and stomach in order to prevent the escape of gastric and duodenal contents during the suture of the mucosal layer. The heavy Payr clamps are removed from the operative field where their weight tends to cause undue traction as the knots are being tied. Frequently, it is impossible to place an enterostomy clamp on the duodenum distal to the serosal suture layer in which case closure is carried out without a clamp and the duodenal contents are controlled by the use of small moist gauze sponges. With the light enterostomy clamps in position the posterior serosal layer is tied. All except the upper and lower sutures are cut and the fragments of crushed stomach and duodenum which lay in the Payr clamp are removed with scissors (Fig. 38). Figures 39 and 40 demonstrate the posterior mucosal continuous silk suture traction on the upper and lower serosal sutures assists in the placement of this suture. In placing this row either a curved or a straight needle may be used preferably the latter unless the duodenum is unusually fixed and cannot be delivered into the wound. When the upper angle has been reached the suture as seen in Figures 40 and 41 is changed to the Connell stitch going in and out of each side before crossing over to the opposite side. The final closure of the mucosal layer is seen in Figures 42 and 43, the final stitch enters the bowel and is usually tied to the original knot on the inside. Such mucosal sutures wherever placed in the alimentary tract always slough away and dis-

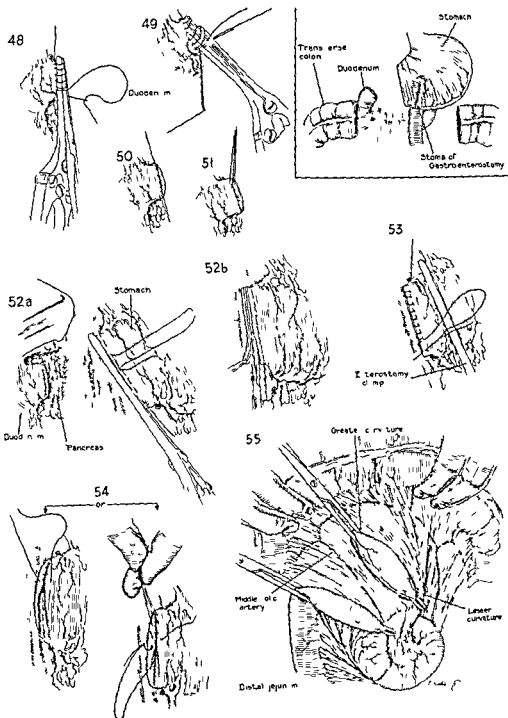
appear, and there has never been proof of the contention of some that non absorbable sutures increase the likelihood of ulceration occurring at the suture line. Figure 44 shows the placement of an anterior row of serosal mattress sutures which when tied, complete the anastomosis. This row should not be placed until after the removal of the enterostomy clamps in order that one may test the completeness of the mucosal closure before placing the serosal sutures. In Figure 45 is shown the approximation of the rents in the mesenteries by additional sutures. Figures 46 and 47 demonstrate how, when the duodenal opening is small the gastric opening may be fitted to it. One may close first the excess of stomach by a running mucosal suture, then continue this around the anastomosis between stomach and duodenum finally covering over this mucosal suture with the usual interrupted mattress sutures. Another common procedure is to enlarge the duodenal opening by a short, horizontal incision dotted in as 'line of incision' in Figure 39. When the upper and lower limits of the duodenum are pulled apart this plastic incision adds double its length to the opening (4).

BILLROTH II REPAIR (FIGS 48-55)

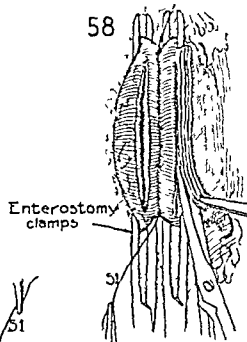
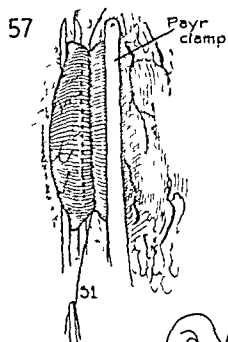
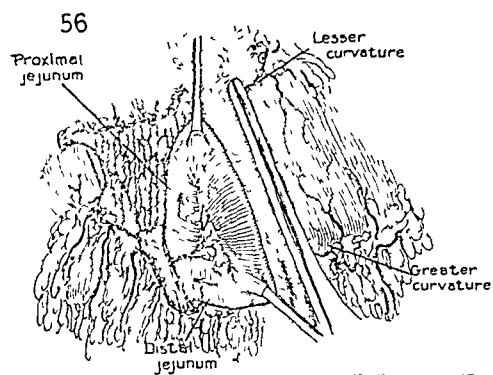
The general alignment of the viscera after this operation has been completed is shown in the inset (Figs 48-55). Figures 48 and 49 demonstrate the placement of an over and over suture to close the duodenum. Note that if an ordinary hemostat is placed on top of the Payr clamp, it leaves the suture loose enough so that the Payr clamp as seen in Figure 49, can be withdrawn before tightening this suture. When this suture has been tightened as seen in Figure 50 the stump of the duodenum is further invaginated and covered in, as seen in Figure 51 by a layer of mattress sutures. The treatment of the end of the stomach may be one of the two methods shown in Figures 52 and 53. To the left (Fig. 52) is shown the placement of a running suture close to the Payr clamp, after which the crushed edge of the stomach which had lain within the Payr clamp is removed with scissors (Fig. 52b). To the right is seen closure of the open end of the stomach, which consists merely of the over and over Lembert suture after removal of the Payr clamp but with the enterostomy clamp in place (Fig. 53). The von Petz sewing clamp may be used as a substitute for the above methods. After the primary suture has been placed, one may close the serosa, as seen in Figure 54 choosing between a continuous Cushing suture seen to the left or interrupted mattress sutures as seen to the right. With the ends of



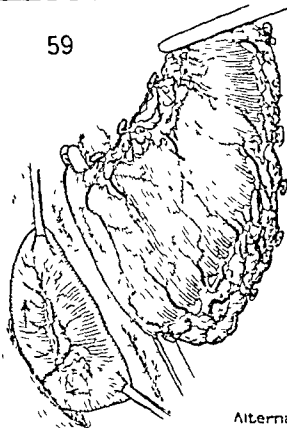
Figs 36 to 47 Gastrectomy, Billroth I repair



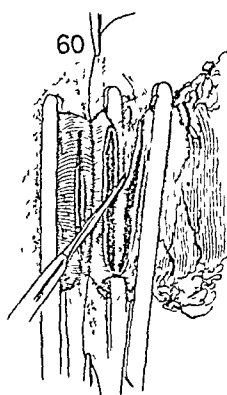
Figs 48 to 55 Gastrectomy Billroth II repair



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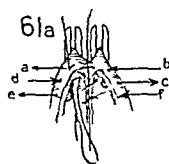
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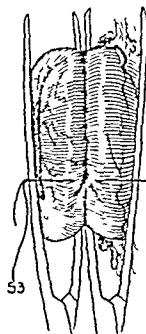
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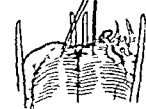
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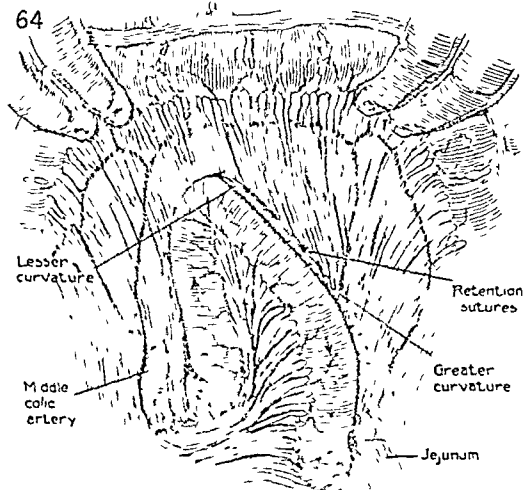
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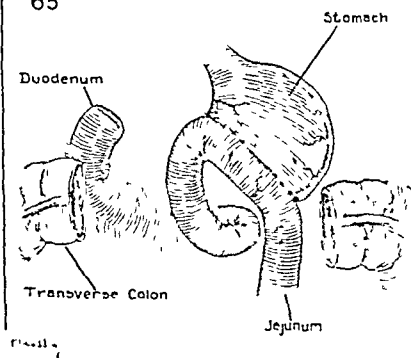
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Figs 56 to 65 Gastrectomy, Pólya repair

both stomach and duodenum closed, simple gastro-enterostomy is carried out as already described in Figures 6 to 21 placing the stoma at the lower border of the stomach at least $1\frac{1}{2}$ inches above the now closed original gastric opening

POLYA REPAIR (FIGS 56-65)

The inset in the lower right hand corner of plate containing Figures 56-65 is a schematic drawing of the position of the viscera after this operation is completed (Fig 65). The operation is as originally undertaken to save the time consumed in the Billroth II procedure in which the open gastric end must be closed and then a new gastric opening made for the gastro enterostomy. In principle it consists of suturing the jejunum on the open end of the stomach. This type of repair or some modification is the safest and most useful method if extensive resections have been previously performed. The jejunum, according to the extent and position of the disease, may be retrocolic or antero-colic. The antero-colic procedure is unsatisfactory when it is impossible to secure a sufficiently long loop of jejunum to bring in front of the colon without having the weight of this bowel press upon the small gut and cause obstruction. Figure 56 shows the beginning of the anastomosis between jejunum and stomach. The duodenum has been closed and a long loop of jejunum has been brought through a rent in the mesentery of the colon to the left of the middle colic artery and near the ligament of Treitz. The jejunal loop is then seized in an enterostomy clamp and this is approximated to the posterior surface of the stomach where a serosal suture line is placed (Fig 57). This suture may be a continuous suture or comprised of interrupted mattress sutures. This is carried out with intestine held in an enterostomy clamp while the stomach is still held in the Payr clamp. The Payr clamp is then removed after an enterostomy clamp has been placed across the stomach at least 2 centimeters proximal to the Payr clamp following which the crushed border of the stomach is removed with scissors. An opening is then made into the jejunum approximating in size the opening into the stomach (Fig 58). When a very high resection is done the stomach may be used as a retractor as shown in Figure 59. If this step is used, an enterostomy clamp is applied at the site selected for resection to aid in fixing the stomach

wall, while the jejunum is anchored by interrupted mattress, or a continuous serosal, suture. When the posterior serosal suture line is completed the excess of stomach is removed (Fig 60). With both fragments of the bowel open the openings are then approximated by continuous mucosal suture (Fig 61) carried out after exactly the same technique as utilized for gastro enterostomy turning the corner with a Connell suture (Fig 61a) and tying the final knot on the inside. Enterostomy clamps are then released to inspect for leakage and bleeding and the anterior serosal layer is completed (Fig 62). This is quite as satisfactorily performed with continuous as with interrupted sutures. Finally at the upper and lower angles of the new stoma additional sutures are placed so that any strain placed upon the stoma is met by these additional serosal sutures and not upon continual sutures of the anastomosis (Fig 63). The final steps of this procedure are visualized in Figure 64, where the new stoma is seen in the rent in the mesentery of the colon to which it is sutured as in the operation of gastro enterostomy.

Postoperative care. The patient, when conscious is placed in Fowler's position. The fluid balance is maintained by the intravenous or subcutaneous administration of 5 per cent glucose solution—approximately 3000 cubic centimeters a day. Pulmonary complications are anticipated and guarded against as far as possible by frequent change in position, hyperventilation etc. Water in sips is allowed 24 hours after operation. If there is a tendency to vomiting, constant gastric suction is instituted. The diet is slowly increased but it is advisable to continue a rather strict "ulcer regime" for at least several months.

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ANKYLOSIS OF THE TEMPOROMANDIBULAR JOINT

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IT IS the purpose of this article to present a clinical study of 33 cases of chronic ankylosis of the jaw. All of the patients were operated upon by me over a period of 15 years, and the material has been available through the files of the Massachusetts General Hospital, the Massachusetts Eye and Ear Infirmary, and through private case records. I feel that there are certain advantages in having seen and followed these cases personally over a period of years, and since no real unanimity of thought or standardization of methods has come about as yet in this field, it is important to continue the presentation of fairly detailed studies. No radical departures have been made from the usual operative methods, but I hope that there is a gain in simplicity.

DEFINITION

Chronic ankyloses of the jaw are sufficiently complex to require at least a simple plan of classification. They may be divided into two groups: first, those in which the ankylosing factors lie in the joint proper, these being called intra-articular or "true" ankyloses, and second, those in which the pathology lies outside the joint proper, the "false" ankyloses. The intra-articular ankyloses are much more common (28 cases in this series), and they are defined in degree as complete or partial in type. Complete ankylosis is taken to mean in this article less than 5 millimeters of opening power. Generally this means bony ankylosis. Similarly in any individual case, it is important to know whether the ankylosis is unilateral or bilateral. The *extra-articular* cases of ankylosis are similarly classified. Generally, these are partial, fibrous, and unilateral in type. They are less common (5 cases in this series).

ETIOLOGY

The predisposing cause of chronic intra-articular ankylosis of the temporomandibular joint is either disease or trauma. The etiological infection may have occurred in the joint itself, in a suppurative process in the neighborhood of the joint, in the mandible, in the middle ear, or in the mouth. The predisposing injuring agent is usually some sort of external violence transmitted to the temporomandibular joint or joints through the

mandible. Fracture of the neck of the condyle may cause ankylosis. Frequently, because of the slow evolution of ankylosis, the direct connection between cause and effect is unknown to the patient, his family, or his physician. So called congenital ankylosis is at present considered as evolving from a birth injury, and thus to be traumatic in origin. A recently reported case by Burket does not alter this conception. The end-result of disease or injury may lead to the formation of scars and destruction of the joint.

As it is generally recognized, injury is the most important single cause of ankylosis. A history of injuries, such as blows to the jaw, coasting accidents, falls, automobile accidents, and jaw fractures, was obtained in 8 of the 28 cases of intra-articular ankylosis.

Table I enumerates the etiological factors in the remaining 20 patients.

These "unknown" cases followed mumps, poliomyelitis, "convulsions," burns of the face, and "not stated."

Half of these intra-articular ankylosis cases had their onset in the first 10 years of life. The second decade gave rise to 4 cases and the ages above these groups gave rise to 6. Tables II and III will show by their disparity the unusual length of time which elapses between the onset of the condition and its final disposition.

The etiological factor or factors were well defined in the author's 5 cases of extra-articular ankyloses. Postirradiation injury and scarring following the treatment of intra-oral carcinoma accounted for 2 cases, injuries involving the coronoid process caused 2 cases, and post-diphtheroid intra-oral scars caused 1. Involvement by scar tissue of muscles or soft tissues anywhere between the joint and symphysis of the mandible may limit the jaw movements. The few cases in this series are fair examples of the varied pathological processes and injuries which may bring about this type of ankylosis. Depressed fractures of the zygomatic process if not reduced will create limitation of jaw motion.

PATHOLOGY

The pathological changes found in intra-articular ankylosis at the time of operation vary greatly in extent. The duration of the ankylosis, the etiology, and roentgen studies are of some

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help in forming a pre operative estimate of the pathology, but in general one must wait for the surgical exposure of the joint before an accurate picture is had. It is important to know that in these cases, even with complete ankylosis for many years, the unaffected opposite joint remains perfectly normal. Bilateral cases of ankylosis are rather infrequent (4 in this series) and usually follow rheumatoid arthritis, or injury in which the traumatic force is transmitted to both joints by the mandible. Further statistics show in this group that there were 11 cases of partial ankylosis and 17 cases of complete bony ankylosis.

The pathological findings in intra articular ankylosis present usually progressive degrees of joint destruction (5, 6, 7). The earliest changes are in the cartilaginous and capsular structures. The meniscus is often completely destroyed quite early, the joint space is narrowed by this and by changes in the articular cartilaginous surfaces. The joint capsule shrinks and adheres to the adjacent structures. Fibrous bands develop and thicken sometimes to the point of obliterating most of the joint space. These fibrous bands and the scarred joint surfaces may become calcified. The condyle seems to have a special tendency to develop proliferative bony changes until it becomes thick and massive. This is especially marked in the young because the condyle does not acquire its normal length, and the relative shortening often makes the coronoid process appear longer than the condyle. The mandibular fossa flattens out and becomes shallow. True osteomas and exostoses are possible. Finally the whole joint area may lose its normal landmarks in a mass of bony union.

In the author's experience, true osteomas extending either from the posterior surface of the head of the condyle or the coronoid process are especially noticeable in cases of partial ankylosis. The overgrowth of bone is primarily responsible for the limitation of motion. Therefore it is not surprising that mechanical means of dilating the jaw are unsuccessful.

DEFORMITY

Intra articular ankylosis occurring in the young (before the age of 15) and present for an appreciable length of time causes great deformity. When the ankylosis is complete the hypoplasia of the mandible is most distinct. In bilateral ankylosis generally there is a symmetrical lack of growth but in unilateral cases marked asymmetry is present with the chin deviating to the affected side because of the lesser growth of the mandible

on that side. There are two explanations offered for this hypoplasia. The first is that the ankylosed joint directly affects an important growth center in the condyle and thus interferes with normal growth. The second is that lack of proper function leads to the hypoplasia. Probably both of these factors play a part. The dental literature in the past has stressed the effects on mandibular growth of misplaced and unused teeth in the young and this may be a third factor (4). There is considerable evidence that interference with normal growth centers is the most important factor, since destructive and bony changes in the mandible near the angle or involving the ascending ramus from any cause commonly result in hypoplasia of the mandible on the affected side. In osteomyelitis and similar conditions with no joint disease and slight loss of function such is often the occurrence. Moreover in bony ankylosis the unaffected side grows almost to normal size despite the fact that it has been largely deprived of its function.

In young patients secondary pathological changes are of great importance, especially so far as function and facial contour are concerned. In the long standing cases of early ankylosis the face is flattened on the unaffected side and full on the affected side. The chin is deviated and retracted to the affected side. The deformity varies directly with the age of onset and with the degree of ankylosis. It varies directly with the duration up to the age of 15 years. The teeth may be in poor occlusion and usually the poorest occlusion is on the unaffected side. Here the normal bite axis changes in the mandible by a certain amount of lingual displacement of the teeth. Poor growth hygiene and lack of proper dental care lead to much caries and decay in the teeth of these patients. In complete ankylosis there is often a very great degree of decay on the occlusal surfaces of the teeth. Constitutionally the patients are usually below par. Many show definite signs of malnutrition but a few show no effects in their general nutrition and constitutional development (Case 7).

In extra articular ankylosis the pathological process varies with each case. Scarring of soft tissues or the deeper muscles underlies the ankylosis. The intra oral and intra alveolar mucosa may be involved by dense scars. Fibrosed and shrunken areas in the muscles of mastication in one small area may prevent jaw function. Often the exact site of the scar tissue cannot be determined by inspection and is discovered at the time of operation. Hypoplasia of the mandible in extra articular ankylosis is very rare.

TABLE I — ETIOLOGICAL FACTORS

	Cases
Abscess of the mandible	6
Sepsis of the joint	2
Chronic rheumatic arthritis	3
Zygomatic abscess	2
Temporal abscess	1
Throat infection	1
"Unknown"	5

SYMPTOMS AND DIFFERENTIAL DIAGNOSIS

These patients suffer but slight difficulty with their speech. The limitation in jaw function, the poor mouth hygiene, and the deformity are the main factors of disability. It is surprising that very few give a history of pharyngeal infection or tonsillitis, which would be quite serious in these patients.

A few points in differentiating between the various types of ankylosis are important, one point at least has escaped description in the literature, so far as I have ascertained. In my experience, observation of the patient when he is asked to thrust forward the jaw is of great value and usually enables one to differentiate between intra-articular and extra-articular ankylosis. With the extra-articular lesion the joints themselves are normal and the jaw glides forward equally on both sides and with no deviation to the left or right. With an intra-articular ankylosis there is no forward motion on the affected side and this results in a slight deviation of the chin to the affected side. In bilateral ankylosis (intra-articular), no forward thrust is possible. This valuable sign can generally be elicited. Slight opening and lateral movement are always possible because of the elasticity of the mandible itself, even with complete bony ankylosis.

Roentgen studies of both joints must be made, of course, and are of great aid. Usually the articular lesion can be made out distinctly. Bony changes and overgrowths are visualized and this information may be of aid in the surgical treatment. In the early cases of intra-articular ankylosis the shortening of the ramus on the affected side is notable. Blair has described the presence of a deepened pre-angular notch on the affected side in these cases.

To recapitulate, the examination of the patient should bring out several important points. In the usual case of intra-articular ankylosis, the chin is already deviated to the affected side. If there is only partial ankylosis, it will be noted that still farther deviation of the chin to the affected side occurs on opening the mouth. At any rate the same sign may be elicited by asking the patient to thrust forward the jaw. These

TABLE II — AGE AT ONSET OF ANKYLOSIS

	Years	Cases
A	From 1-10	17
B	From 11-20	4
C	From 21-52	5
D	Unknown	2
		Total 28

TABLE III — AGE AT TIME OF OPERATION

	Years	Cases
A	From 1-10	4
B	From 11-20	15
C	From 21-52	9
		Total 28

actions determine the side affected. When no forward thrust is possible the ankylosis may be considered bilateral.

With extra-articular ankylosis there is no interference with joint function so far as its sliding forward is concerned and the patient readily can thrust the jaw forward.

The history and careful inspection are of especial value in extra-articular ankylosis for determining on which side the lesion lies. At times the patient volunteers that the right or the left side "catches" and thus affords an additional clue (Case 1). In extra-articular ankylosis it often may be impossible to go any further than to determine the side affected and to leave until the time of operation the discovery of the specifically involved area of ankylosing scars.

TREATMENT

A Mechanical devices Mechanical devices are useful in a very few cases. These are, first, in mild partial ankylosis cases due to cicatricial bands outside the joint proper, and second, in some early rheumatoid arthritic cases. After extensive plastic operations about the face, mechanical devices are useful to hasten the development of jaw function. Similarly these devices and exercisers are used after injuries and surgery involving the soft tissues of the mouth. *But in chronic intra-articular ankylosis they have no place.* In my hands they have proved a complete failure, and this seems to be the consensus with others at this time (6). The most useful type of mechanical device is one which gives continuous expansive pressure. For this

help in forming a pre operative estimate of the pathology, but in general one must wait for the surgical exposure of the joint before an accurate picture is had. It is important to know that in these cases, even with complete ankylosis for many years, the unaffected opposite joint remains perfectly normal. Bilateral cases of ankylosis are rather infrequent (4 in this series) and usually follow rheumatoid arthritis, or injury in which the traumatic force is transmitted to both joints by the mandible. Further statistics show in this group that there were 11 cases of partial ankylosis and 17 cases of complete bony ankylosis.

The pathological findings in intra articular ankylosis present usually progressive degrees of joint destruction (5, 6, 7). The earliest changes are in the cartilaginous and capsular structures. The meniscus is often completely destroyed quite early. The joint space is narrowed by this and by changes in the articular cartilaginous surfaces. The joint capsule shrinks and adheres to the adjacent structures. Fibrous bands develop and thicken sometimes to the point of obliterating most of the joint space. These fibrous bands and the scarred joint surfaces may become calcified. The condyle seems to have a special tendency to develop proliferative bony changes until it becomes thick and massive. This is especially marked in the young because the condyle does not acquire its normal length and the relative shortening often makes the coronoid process appear longer than the condyle. The mandibular fossa flattens out and becomes shallow. True osteomas and exostoses are possible. Finally the whole joint area may lose its normal landmarks in a mass of bony union.

In the author's experience true osteomas extending either from the posterior surface of the head of the condyle or the coronoid process are especially noticeable in cases of partial ankylosis. The overgrowth of bone is primarily responsible for the limitation of motion. Therefore it is not surprising that mechanical means of dilating the jaw are unsuccessful.

DEFORMITY

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vital materials were interposed between the freshly created bony surfaces at the time of operation, but today only living transplants or pedicled flaps enjoy any consideration. The necessity for the use of some material to cover fresh bone ends in arthroplastic surgery is generally recognized as an important principle, and I feel that the mandibular arthroplasties should form no exception.

Whatever the approach to the joint, a further important point lies in creating the bony gap high up in the ramus and with this in mind, sectioning through the neck of the condyle or completely across the ramus at this level will result in optimal functional results.

The only important approach to the joint used in this series aside from the usual vertical incision to be described has been an external incision below the border of the mandible at the angle. This external incision is not new and has been emphasized recently by Risdon. Its main advantage to my mind lies in the fact that it affords an excellent avenue for explorations of the ascending ramus and thus it is of great value for the purpose of exploration of the masseteric and pterygoid regions for scar tissue (Cases 1, 4).

As it is generally well recognized an adequate operation on the temporomandibular joint for arthroplasty must be made as safe as possible in several respects. First, must be borne in mind the danger to the facial nerve of operative procedures in this field. Second, the proximity of the internal maxillary artery to the neck of the con-



Fig 2 Photograph showing the incision line for arthroplasty

dyle is an important surgical fact. Finally the rich venous supply makes operative and post-operative hemorrhage a constant danger, and the surgeon must be prepared to deal with it.

The incision used by the author lies directly in front of the ear (Fig 2) but generally it is not carried downward to a point over the level of exit of the main trunk of the facial nerve. Also the primary incision is made only through the skin, and only by gross carelessness could it penetrate to the depth at which the trunk or the main divisions of the nerve lie. The branches of the

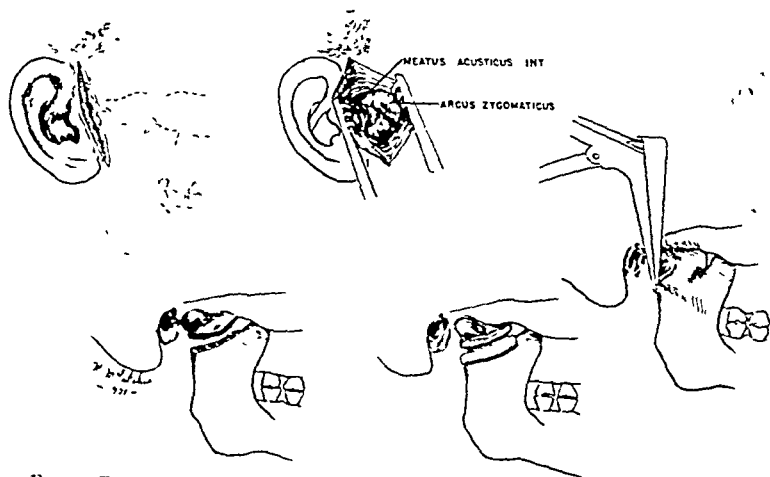


Fig 3 Diagram showing the various steps in the operative procedure for arthroplasty of the temporomandibular joint. Incision line, exposure of operative field, position of the back biting forceps at the initial cutting, the line through which definite section of bone is removed, a sufficient amount of fascia is inserted between the cut ends of the bone to eliminate "dead" space.

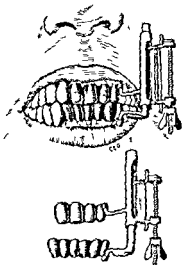


Fig. 1. Mechanical exerciser for the jaw which works by the constant pull of elastic bands. The apparatus is attached over several lower front teeth by metal caps. It is used only in a limited number of special cases of extra articular ankylosis.

reason the author often provides fairly stiff rubber tubing which is just too tight to fit well between the teeth to be used several hours daily. This wedging should not be enough to cause any sense of fatigue to the jaw. Larger tubes are substituted later. The author has tried several forms of more complicated apparatus and many have been described which are effective exercisers or dilators. One such apparatus (Fig. 1) which I use works by the constant pull of elastic bands. These force down the lower half of the apparatus which is attached over several lower front teeth by German silver caps. This sort of device or a similar variation can be safely used in a certain number of special cases of extra articular ankylosis.

Forcible opening of the ankylosed jaw under anesthesia is to be condemned unless there is some surgical emergency. Such procedures always traumatize and perhaps hasten the formation of complete bony ankylosis.

The author in 1 case of partial intra articular ankylosis opened the jaw under general anesthesia and left it open with an inserted gag. Later mechanical devices and exercisers were used faithfully for 6 months and in spite of this limitation rapidly increased. Two years later complete bony ankylosis developed which was relieved by arthroplasty. In several other cases in this series a history of such forcible dilatation was

obtained and in no case had the procedure been helpful.

b Surgical considerations Before entering upon the actual description of the operative technique, I would present a few observations concerning the selection of cases and a consideration of procedure. I believe that only a short period of observation is necessary to determine the presence of true intra articular ankylosis. As has been pointed out in these cases the use of exercisers and manipulations is futile. Second there seems to be no valid reason to delay surgical intervention because of the youth of the patient. The youngest patient in this series was 3 years of age. Early surgery may prevent deformity and alleviate more formidable procedures in the future.

In cases in which bilateral ankylosis is present there is no necessity for a double simultaneous operation on both joints. In 4 such cases one joint was operated on at one occasion and the second joint at a later date. Two of these patients had chronic rheumatoid arthritis and in 1 of them for reasons beyond our control the second operation was performed almost 2 years later. The lack of immediate use of the newly created joint thus does not seem to affect the results (Case 6). It will be noted later that it has not been my custom to use mouth gags or dilators after operation or to rush the joint into immediate use and I do not hesitate to delay non use of the fresh arthroplasty by postponing the second operation to a later date in bilateral cases. It is interesting that 2 bilateral cases were the result of chronic rheumatoid arthritis with multiple joint involvement. Dorrance *et al* have warned against surgery in such cases but in the 3 cases in this series caused by chronic rheumatoid arthritis the functional results were excellent and were doubly important in their results by improving the nutrition of the patients.

When a secondary deformity is present, no effort is made at correcting it at the same time that the arthroplasty is performed. I do not feel that mandibular retrusions of this type should be corrected by surgical procedures through the ascending ramus. No exception is made in these cases for this reason and for the reason that simultaneous correction of the retrusion would usually require a more extensive surgical sectioning often on both sides. This procedure can be done at a later date more safely and adequately (Cases 7, 8, 10).

Several approaches to the temporomandibular joint and a variety of incisions have been and are being used at the present time. In the past non



Fig 8

Fig 11



Fig 9

Fig 10

Fig 8 Photographs of patient with partial ankylosis. The lower jaw is slightly underdeveloped (Case 2)

Fig 9 Roentgenogram showing large osteoma at the neck of the condyle (Case 2)

Fig 10 Roentgenogram showing the osteoma and head of the condyle removed (Case 2)

Fig 11 Photograph showing patient after operation (Case 2)

Operation The following is a rather detailed description of what has proved to be in my own cases a successful and efficient method of operating on true intra-articular ankylosis of the jaw.

A vertical skin incision is made just anterior to the ear, and extending its entire length. The superficial temporal vessels are found and either tied off or retracted posteriorly.

The temporal fascia is now located and the zygomatic process of the temporal bone is exposed as a necessary landmark. Just below the zygomatic arch there will be found the temporomandibular joint and the head of the mandibular condyle. The outline of the condyle is usually prominent and it can be easily defined no matter what changes have taken place in or about it.

The further procedure is to cut down upon the condyle with a vertical incision and to make a subperiosteal exposure of the head and neck of the condyle. The subperiosteal exposure is now carried posteriorly until the posterior upper border of the condyle is well defined and clear for the distance of one-half inch. It is now possible to begin the forward resection of a segment of the condyle. With an upcutting Kerrison punch forceps it is possible to proceed anteriorly toward the sigmoid notch with a high degree of safety. By keeping within the periosteum and carrying out cutting procedures under direct vision, there is little danger to the internal maxillary artery, which lies just deep to the neck of the condyle. The use of a half curved gouge-like chisel is often

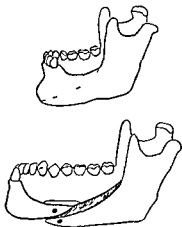


Fig 4

Fig 4 Diagram showing diagonal cut through the body of the mandible for the lengthening of the short side of the mandible

Fig 5 Photograph showing method of pulling the chin forward after sectioning of the bone. The median bar is anchored to the forehead and the upper teeth. A brass



Fig 5

wire is passed through a hole at the symphysis and comes through the skin so as to form a loop in front of the chin. An elastic band extends from the wire loop to the bar in front.



Fig 7

Fig 7 Roentgenogram following the removal of section of ramus and coronoid process (Case 1)

facial nerve supplying the frontal and orbicular of the eye muscles are well anterior and out of the operative field. But in spite of this they may be stretched and suffer temporary paralysis. To guard against injury to the important blood vessels as it will appear later the use of surgical burrs or the gigli saw for bone resection is discarded. All cutting is carried out under direct vision with up-cutting bone punches, rongeurs and at times the chisel.

Anesthesia. Anesthesia presents certain difficulties in these cases. Careful preparation of the patient and a little forethought may prevent undesirable possibilities. Vomiting is particularly dangerous and apparatus for suction should be available during the operation and at the pa-

tients bedside during recovery from anesthesia. Maintaining an airway may be difficult since the tongue cannot be reached and pulled upon. Before anesthesia is given a 1 centimeter heavy rubber tube may be inserted over the tongue through open spaces which these patients always have through loss of previously extracted teeth and this may be inserted deeper into the pharynx later and thus provide an additional airway. Nasal tubes may be used for etherizing or to provide an additional airway. In this group of cases rectal anesthesia was used occasionally and avertin and ether combinations in other cases. As an additional precaution a tracheotomy set should be ready and available although in my experience its use was never required.

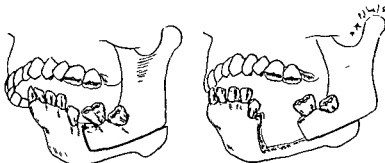


Fig 6 Diagram showing L-shaped cut which may be used bilaterally for elongating the body of the mandible



Fig 8

Fig 11



Fig 9

Fig 10

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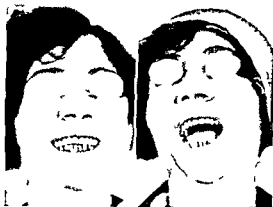


Fig 12 Photographs showing pre operative and post operative views of patient with bilateral complete ankylosis of temporo mandibular joint. Patient was also the victim of chronic progressive multiple arthritis (Case 3)

useful when the condyle is very thick. The superficial part of the resection may be carried out with the chisel biting instruments being used for the deeper parts. The segment of bone removed should be at least a quarter of an inch in width (Fig 3)

In some cases the sigmoid notch is seen to be very shallow, and if this is so the resection is carried out for the entire width of the ramus. Similarly the resection must be carried across the ramus when the coronoid process is osteomatous or when it is seen to be interfering in any way with the function of the mandible.

No unusual instruments for retraction are necessary for the above procedures. A certain amount of traction on the tissues is necessary to maintain exposure, and the use of the head mirror or head lamp is of considerable aid in obtaining the proper lighting of the field.

When the resection is completed an assistant is directed to open the mouth. An excursion of 2 to 3 centimeters is discovered to be possible. At this time an inspection of the temporomandibular articulation may show purely fibrous joint changes and scarring, and if this is the case the head of the condyle may be dissected out thus creating a larger bony gap. If there is any bony union, no such attempt is made since it would be dangerous because of the proximity of the middle cranial fossa.

The operation has not been particularly bloody, generally it is simply a matter of controlling venous oozing. In one case considerable venous bleeding was encountered which was controlled readily by gauze packing. Fascia lata was substituted for the gauze at the end of the operation



Fig 13 Roentgenogram showing ankylosis from deep radiation scar. Postoperative roentgenogram shows the amount of tissue missing (Case 4)

under slight pressure and acted as a good hemostatic. In another case venous oozing at the very end of the operation was brought under control similarly with the fascia lata transplant. The oblong segment of fascia lata transplant (about 1.5 by 2.5 inches) is inserted into the area from which the bony segment was removed. An attempt is made to tuck the edges of the transplant under the bone ends, but it is not sutured to the surrounding structures. It has great immediate value in filling the dead space between the bony stumps and in controlling immediate or postoperative filling of the area with hematoma.

The wound is closed with a few deep catgut sutures and a superficial drain which does not come in contact with the fascia lata transplant is placed in the upper end of the wound. A pressure bandage is applied over the usual dressings. The patient's mouth receives no special attention or care at this point. No mouth gag or other apparatus is used.

Postoperative care. A liquid diet is given to the patient and the jaw kept entirely at rest for 1 week. The drain is removed in 24 hours. The patient is advised against chewing or working the jaw for several days. It is the author's belief that this period of rest insures viability to the transplant and thus helps prevent a recurrence of the ankylosis. Faster and cleaner healing results in the immobilized wound.

Postoperative complications. In none of the cases in this series did any serious sepsis occur. A few cases drained considerable serum through the drain site for a few days. Hospitalization over 3



Fig 14 Pre-operative photographs of patient with complete ankylosis of the temporo-mandibular joint, showing definite shortness of the left mandible and retraction and deviation of the chin to the left side (Case 7)



Fig 15, left Roentgenogram showing very thick bony ankylosis (Case 7)



Fig 16 Postoperative photograph of patient (Case 7)

weeks was never necessary. No permanent paralysis through facial nerve injury occurred in this group of cases. In a few patients temporary paralysis of the musculi occipito-frontalis and the orbicularis oculi developed, lasting up to 4 or 5 weeks. One operative failure resulted (Case 5) necessitating a second operation.

Most important is the early institution of dental care of which the patient may stand in great need. Proper teeth will thus make possible efficient mastication. In the follow up of cases, it has been found that improvement of function for 6 months generally means a good prognosis.



Fig 17 Correction of external deformity by elongating the short side of the mandible. Roentgenogram shows the wire suture connecting the two ends of the bone, twisted and cut short, and allowed to protrude through the mucous membrane of the mouth (Case 7)

Follow-up On discharge the patients were advised to increase the use of the jaw gradually, by definite periods of gum chewing and by the mastication of tough food. The use of active motion and not passive methods was the plan adopted. No apparatus or exercisers were used in any case. A most detailed report was available in 29 cases by virtue of a questionnaire sent to the patients recently. Needless to say, the importance of follow up and observation for years is of extreme value in this type of reconstructive surgery. Four patients were followed in the clinic after operation but did not answer the questionnaire. In all the successful cases the new joint or joints were remarkably free of pain or discomfort.

CORRECTION OF DEFORMITY

Surgical correction of the retruded mandible to improve the dental occlusion and to relieve the patient of a notable deformity is necessary in a



Fig 18 Postoperative photographs of patient, following operation for correction of the external deformity (Case 7)



Fig 10 Roentgenogram showing complete bony ankylosis on the right side duration since childhood (Case 8)

certain number of cases. As stated no attempt is made by the author to combine the surgical treatment of ankylosis and that of retrusion. After the arthroplasty proper dental care and orthodontic procedures may in themselves bring about an efficient occlusion. Corrective surgery must be undertaken with future orthodontic or prosthetic necessities and possibilities in mind. It sometimes is better to limit the advancement of the mandible to less than the ideal esthetic position for such reasons. Purely cosmetic surgery is always pos-



Fig 20 Photographs showing complete ankylosis of the jaw with marked underdevelopment of the mandible (Case 8)

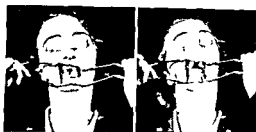


Fig 21 Postoperative photographs of patient (Case 8)

sible for building up the chin without disturbing the dental articulation (Case 8). On the other hand, with extreme shortening of one side of the mandible, sometimes as much as 2.5 to 3 centimeters, orthodontic treatment and considerations become less important than the correction of the retrusion for improvement of mandibular function.

In general, correction of the retruded mandible in children is best delayed until the permanent bicusps have erupted, thus enabling intelligent postoperative orthodontia. For this reason, it is best with children between the ages of 5 and 10 to have corrective surgery delayed until the permanent bicusps have made their appearance.

The author makes use of an oblique or an 'L' shaped section in the body of the mandible in cases of unilateral retrusion. The surgical procedures involved do not differ in these post ankylosis retrusions from those resulting from fractures, osteomyelitis, or other causes of this deformity.

The operative procedures are carried out intraorally, the main purpose being to elongate the short side of the mandible.



Fig 22 External deformity was corrected by (1) elongating the right side of mandible (2) by transplantation of a suitable section of bone taken from tibia (Case 8)

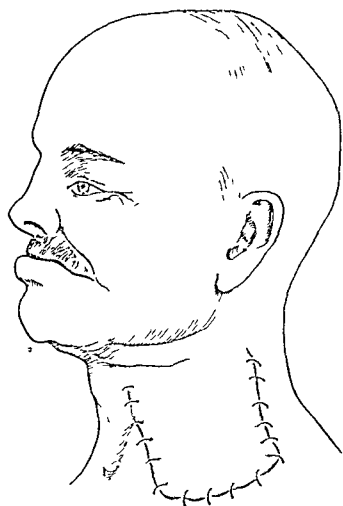


Fig 23 Diagram showing a delayed flap which was later transferred to the side of the mouth to replace the missing mucous membrane lining of the cheek (Case 9)

Operation An incision is made over the crest of the alveolar ridge beginning in the retromolar region and coming forward to the second bicuspid or even further forward. Adequate dental splints are prepared for control of the fragments after separation of the parts. It is sometimes necessary to extract one tooth if the section cannot be made without passing through the tooth root. The next step lies in exposing freely the buccal side of the

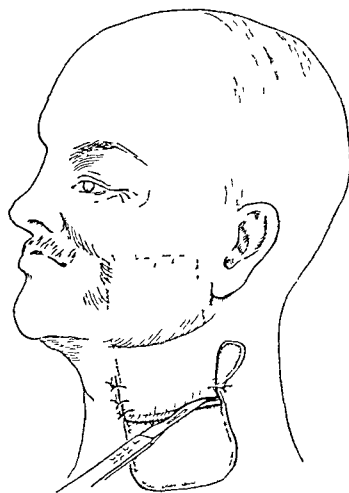


Fig 25 The lower end of the delayed flap was cut through and sutured to the buccal side of the lower alveolar process while the unused part was resutured to its original position (Case 9)

lower jaw as far as it is deemed necessary. Then with a surgical burr the mandible may be cut through diagonally, as seen in the diagram (Fig. 4)

Holes are made in the extreme ends of the disconnected bone with a surgical burr. A brass wire (No. 20 gauge) may be used as a single suture, the ends being twisted together, and by this procedure as much as an inch of lengthening may be



Fig 24 Photograph of patient showing the delayed flap already transferred to inside of cheek through an incision under the lower border of the mandible (Case 9)



Fig 26 Photograph showing patient able to open the mouth wide enough to allow for use of full upper and lower dentures (Case 9)



Fig 19 Roentgenogram showing complete bony ankylosis on the right side duration since childhood (Case 8)

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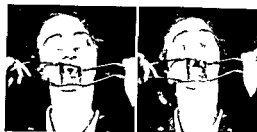


Fig 21 Postoperative photographs of patient (Case 8)

sible for building up the chin without disturbing the dental articulation (Case 8). On the other hand, with extreme shortening of one side of the mandible, sometimes as much as 2.5 to 3 centimeters, orthodontic treatment and considerations become less important than the correction of the retrusion for improvement of mandibular function.

In general, correction of the retruded mandible in children is best delayed until the permanent bicuspid has erupted, thus enabling intelligent postoperative orthodontia. For this reason it is best with children between the ages of 5 and 10 to have corrective surgery delayed until the permanent bicuspid has made their appearance.

The author makes use of an oblique or an "L" shaped section in the body of the mandible in cases of unilateral retrusion. The surgical procedures involved do not differ in these post-ankylosis retrusions from those resulting from fractures, osteomyelitis, or other causes of this deformity.

The operative procedures are carried out intra-orally, the main purpose being to elongate the short side of the mandible.



Fig 20 Photographs showing complete ankylosis of the jaw with marked underdevelopment of the mandible (Case 8)



Fig 22 External deformity was corrected by (1) elongating the right side of mandible (2) by transplantation of a suitable section of bone taken from tibia (Case 8)

CASE 1 Ankylosis from injury to coronoid process, approach from below angle of jaw. T B, male, aged 16 years. This patient was first seen on August 2, 1935, complaining that he was able to open his mouth only one-fourth of an inch. A history of an accident 12 years previously was obtained, at which time the patient fell, running a pencil into his left temporomandibular joint region. Examination showed a complete ankylosis which appeared to be extra-articular. No clue could be obtained as to the ankylosing factor. The patient's statement that he felt a "catch" on the left side had to be given serious consideration. The roentgen examination was entirely negative and showed normal joint outlines.

On May 2, 1936, the patient was operated on through an external incision extending from the angle of the jaw on the left side forward about half way along the lower edge of the mandible. The masseter muscle was located and detached from the ramus at its insertion. The periosteum and remaining tissues were elevated from the posterior and postero-medial aspects of the ramus up to the mandibular notch. The ramus was divided by narrow biting forceps about one-half inch below the mandibular notch. The coronoid process was then resected because it was thicker than normal and it appeared to be pressing tightly against the posterolateral aspect of the left maxilla. The jaw could immediately after this be opened almost 2 inches. The wound was closed in anatomical layers (Fig. 7).

The exposed part of the internal pterygoid muscle was sutured to the masseter muscle as a means of creating a false joint where bone was removed. Examination of the patient months later showed that he was able to open his mouth wide, even though the sectioned area of the ramus had consolidated, because the original cause for the ankylosis was at the region of the coronoid process.

This case demonstrates the necessity at times of choosing the approach under the jaw line near the angle of the mandible whenever the operator is in doubt as to the exact site of the difficulty causing the ankylosis. It is a valuable incision for exploratory purposes.

The following case is of interest because it demonstrates the failure of a variety of mechanical devices and jaw dilators which were conscientiously used with no improvement in the patient's condition, over a period of 3 years.

CASE 2 Partial ankylosis with osteoma; operative treatment for ankylosis after failure of various dilators. P C, male, aged 13 years. This patient was first seen in 1930, with a history of falling at the age of 4 and striking his chin. Three months following the injury a limitation in the opening of his jaw was discovered, and this was described as becoming more evident in the past 9 years.

On examination the mandible was found on opening to move apart only 2 centimeters from the maxilla. The occlusion of the teeth was good and there was no gross deviation of the mandible although there was present a small degree of retrusion (Fig. 8). Some fullness of the face was apparent about the right temporomandibular joint. When the patient attempted to thrust the mandible forward deviation to the right could be detected. Roentgen examination showed thickening and shortening of the right condyle, and proliferative bone changes in the mandibular fossa, and the zygomatic arch (Fig. 9).

In view of the 2 centimeter opening noted, no surgery was advised for 3 years but various mechanical devices

were used in the hope that enough movement might be gained to obviate surgical interference. Unfortunately, all such attempts failed. On the contrary, the limitation of the jaw movement gradually increased, so much so that his dentist complained that he was not able to perform ordinary dental operations under such circumstances.

The patient was operated on March 17, 1934, in the usual manner. The condyle was almost an inch thick, and there was a large osteoma projecting medially into the pterygoid region. The glenoid cavity was quite flat and abnormal in contour and there were present heavy fibrous bands between the head of the condyle and the mandibular fossa. Considerable venous hemorrhage was encountered during resection, but it was controlled by gauze packing. After resection was completed the head of the condyle was dissected from the joint with a scalpel (Fig. 10). There were no postoperative complications and the immediate function of the mandible has remained satisfactory for the past 2 years (Fig. 11).

CASE 3 Bilateral ankylosis in chronic progressive multiple arthritis. A G, female, aged 31 years. This patient was first seen on admission on December 27, 1927, complaining of progressive ankylosis dating back to an attack of multiple arthritis 15 years previously. For several months at that time the jaw joints had been painful. Examination showed a complete bilateral ankylosis. An upper dental plate was present which the patient stated she had not been able to remove for 4 years. Roentgen studies indicated joint changes and osteoma formation in both condyles.

On December 29, 1927, the left temporomandibular joint was operated on in the usual manner. After resection of the condyle in this case a fat and fascia pedicle flap was swung into the dead space. On January 14, 1928, the right temporomandibular joint was operated on and a fascia lata transplant was used on this occasion. Within 3 months the patient was able to open her mouth about an inch. At this time several of the lower bicuspid teeth were extracted and this caused a flareup of her arthritis causing the patient to go to bed for several weeks. On the last admission to the hospital, July 20, 1935, for arthroplasty of a hip joint, the jaw function was still further improved.

This case is of interest in that the success of arthroplasty is demonstrated in a patient with chronic progressive multiple arthritis (Fig. 12).

CASE 4 Extra-articular ankylosis from deep radiation scar. D W, female, aged 24 years. The patient developed an ankylosis of the jaw following the surgical removal 1 year previously of a squamous cell carcinoma of the upper jaw and extensive irradiation of the parotid regions by the implantation of gold radon seeds. Considerable sloughing of tissue and bone followed for some period and for the past year gradual diminution of jaw movement had occurred until the excursion was about one-fourth of an inch. Several months previously a forcible opening of the jaw had led to a fracture of the mandible but no improvement in function.

On examination the buccal mucosa was normal in appearance. A small fistulous opening was present in the mouth opposite the tuberosity of the maxilla. The right parotid gland was atrophic. Roentgen examination showed normal mandibular joints and some loss of bone in the right ramus. Attempts to dilate the jaw gradually by various mechanical means failed entirely and operation was advised.

On July 1, 1936, under ether anesthesia, a 2 inch incision was made just along the lower border of the right mandible forward from the angle. The angle of the mandible was exposed subperiosteally and a good deal of scar tissue

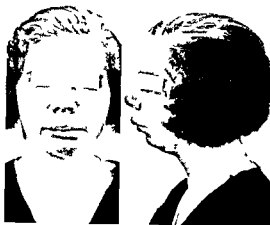


Fig 27 Pre operative photographs (Case 10)

obtained. In his recent cases, the author has in addition utilized an external pull on the symphysis to obtain a more exact and controllable advancement of the symphysis. This is effected by passing a wire suture directly through the symphysis and attaching to this an elastic band leading to a bridging arch of wire coming down over the midline of the face from the forehead. The wire arch or bridge rests on a forehead frame imbedded in dental composition and also on a band on the upper incisors. An extension over the chin affords a point of attachment for the elastic band (Fig 5). A stab wound is made leading to under the jaw line externally and a rubber dam drain is placed in that site (removable externally). The intra oral incision wound is now sutured and the upper and lower jaws are fastened together by elastic bands attached to dental splints previously prepared and cemented to certain teeth. The brass wire may be cut and removed in 3 to 4 weeks, but careful maintenance and after care of splints and tension of the elastics are necessary for some time.

The correction of bilateral retrusion of the mandible involves the carrying out of the same procedure on both sides at the same operation. The incision may be made as in Figure 6.

SUMMARY AND RESULTS

Thirty three cases of chronic ankylosis of the jaw operated on by the author over a period of years have been reviewed. Better standardization and greater simplicity in operative procedure may be claimed except in the 5 cases of extra articular ankylosis. Each of these cases presented an individual problem. The chronicity

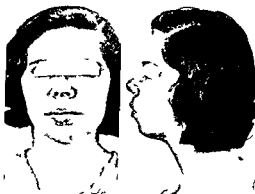


Fig 28 Postoperative photographs (Case 10)

of true intra articular ankylosis and its progressive character should be better realized and earlier operative treatment should be instituted. Non operative treatment is without value. The importance of detecting the presence or absence of horizontal jaw motion as a differential diagnostic point has escaped description in the literature, its applications are here noted.

As to treatment, it may be stated that operation is rarely contra indicated. Arthritics benefit as greatly as do other types of patients. Further in cases of bilateral ankylosis one side may be operated on at a time and delay in instituting the use of the new joint seems to be no factor in the end results. The immediate use of mouth gags or dilators after operation has not been found necessary. Correction of mandibular retrusion when present is not attempted simultaneously with the creation of the new joint.

In the author's operative technique, a simple pre auricular vertical incision, the resection of a sufficient bony gap with the aid of the Kerson back biting forceps and the use of fascia lata transplants have all been necessary and simplifying procedures. Serious hemorrhage and permanent postoperative facial paralysis did not occur in this group. In one case (Case 5) a second operation was necessary and this was successful. In a second similar case of failure the patient will be operated on again (V D).

The 10 case reports present fair examples of the more unusual problems.

The technique for correction of secondary deformities of the mandible and the importance of dental and orthodontic assistance are described and noted.

Finally the value of prolonged follow up of these cases is indicated if any valid conclusions are to be drawn.

On December 27, 1935, the wire that connected the two ends of the mandibular stumps was removed under local anesthesia. On January 23, 1936 (50 days after the operation) the intermaxillary wires were discarded, as there was complete union of the bone. The patient was sent to the Harvard Dental School clinic where suitable artificial dentures were made for him (Fig 18).

CASE 8 Complete ankylosis, corrective operation for deformity B G, female, aged 20 years. This patient gave a history of an abscess of the right side of the mandible at the age of 13 months, followed by necrosis of the bone, the treatment of which required two or three operations. As she grew older, the jaw failed to develop, and there was limitation of the movements of the jaw which gradually became more marked until she developed complete ankylosis and marked underdevelopment of the mandible. Therefore, it had been necessary to remove the two mandibular central incisors in order to feed the child.

Examination on April 23, 1930, showed complete bony ankylosis involving the right temporomandibular joint (Fig 19). The teeth were in a badly decayed condition. There was a marked underdevelopment of the mandible and retraction of the chin (Fig 20). Measurements showed the right side of the mandible much shorter than the left. An arthroplasty was performed at the Massachusetts Eye and Ear Infirmary on May 31, under ether anesthesia, in the usual manner herein described.

Following the operation the patient made an uneventful recovery, and she was able to open the jaws satisfactorily (Fig 21).

The next step in the treatment of this patient was to improve the external appearance. The first operation toward this end was performed on May 29, 1931, under ether anesthesia administered rectally. It consisted of elongating the right side of the mandible. Previous to the operation, however, dental splints were made and cemented over the maxillary and mandibular teeth. The right mandibular third molar—under local anesthesia—was freely exposed for the purpose of utilizing it later on for the retention of the splint.

Incision was made over the right alveolar process beginning from the third molar down to the cuspid region of the mandible (the intervening teeth had been lost). The buccal side of the mandible was freely exposed, and with a surgical burr a diagonal cut was made through the mandible beginning from the third molar and extending gradually downward and forward to the symphysis. Holes were drilled through the end of each fragment, and the two parts were separated as far forward as possible and then wired together. External drainage was established through a buttonhole incision in the floor of the mouth. The patient made an uneventful recovery. There was considerable improvement in the prominence of the chin, but not enough to be satisfactory. A third operation was performed on September 12, in which an osteoperiosteal graft taken from the tibia was inserted in front of the symphysis through a small opening in the side of the face. This operation added further prominence to the chin (Fig 22). As the patient had lost a good many teeth, her dental condition was improved by the construction of artificial dentures.

CASE 9 Ankylosis from intra-oral radiation scars G G, male, aged 60 years. Four years previously, this patient had been operated upon for squamous cell carcinoma of the mucosa of the left cheek. The left cheek had been irradiated and a block dissection of the neck glands on the left side had been performed at that time.

On examination there was found no evidence of recurrence of the carcinoma either locally or in the neck. The mandibular excursion was only 1 centimeter and the cause

for this seemed to lie in a mass of intra-oral scars, occupying most of the buccal mucosa. On account of the ankylosis and also because artificial dentures could not be used, the patient was quite desirous of relief.

In this case I did not feel that free transplantation of skin would be feasible because of dense radiation scars replacing the tissues of the cheek, and consequently decided on bringing up a flap of neck tissue. This was done in three stages. On May 17, 1928, a rectangular flap of skin, its base toward the mandible, was raised from its bed on the side of the left neck, 2 1/2 inches by 4 inches in diameter (Fig 23). This was replaced to its original position by several sutures until the second operation on May 31, 1928. At this time an incision was made along the lower border of the mandible and the mouth was entered along the buccal aspect of the jaw. The intra-oral scar tissue was now excised and it was found that the jaw opened freely. The delayed flap was now raised and drawn directly into the mouth (its outer surface thus becoming the inner surface inside the mouth). The original lower border of the flap was sutured to the upper border of the buccal wound and the two sides were sutured carefully into the borders of the wound (Fig 24). On June 21, 1928, the flap was cut through where it was folded back on itself (Fig 25). There was present enough tissue to create a buccal fold in the mouth by suturing the cut edge to the alveolar process of the mandible. The neck wound was closed partly by the original pedicle and partly by undermining the neighboring tissues. On October 5, 1928, a few superficial intra-oral webs were excised and the surrounding mucosa was ample to cover the area.

The patient at this time, and 2 months later, could open his mouth 4 1/2 centimeters. He was able to have artificial dentures made and could use them efficiently (Fig 26).

CASE 10 Ankylosis with mandibular retrusion, correction of ankylosis and repair of the deformity M S, female, aged 17 years. About 15 years ago the patient, at the age of 2, following an attack of pneumonia, developed an abscess at the angle of the left mandible. This was incised and drained. Immediately following this, the patient had difficulty in using her jaw. This condition became progressively worse so that food had to be pushed into her mouth. In spite of this, however, she got along fairly well. Thirteen years ago an operation had been performed by forcing the jaw open and rubber mouth gag placed between the teeth in order to hold the jaw open. Ten years ago the jaw was opened forcibly and the patient's tonsils removed. In spite of early treatment the ankylosis became progressively worse and as she grew older the deformity of the lower part of the face became more and more pronounced.

The patient was seen at the Plastic Clinic of the Massachusetts General Hospital in January, 1935. Examination showed the patient to have complete bony ankylosis on the left side, also underdevelopment of the left side of the mandible resulting in deviation of the mandible to the left and recession of the chin (Fig 27). The general physical condition of the patient was good. She was advised to have an operation for arthroplasty in order to re-establish the movement of the jaw and also, an operation for correction of the deformity.

On January 28, 1935, under general anesthesia, the usual operation for ankylosis was performed.

The patient made an uneventful recovery and she was able to use her jaws quite satisfactorily. Being thus satisfied that she had obtained the normal motions of the movements of the jaw it was decided to operate and improve the deformity of the face. She was again admitted to the hospital on November 8, 1936. The operation was performed on November 9, under general anesthesia. The purpose of this operation was to elongate the left side of the

discovered adherent to the anterior border of the ascending ramus. The coronoid process was missing. A segment of the ascending ramus as well as the head of the condyle was resected about an inch above the angle of the jaw and a large area of dense fibrous scars was uncovered in the pterygoid region (Fig. 13). The scar tissue was dissected out and this resulted in an exposure of the oral cavity as far as the third molar along the buccal fold. The jaw could now be opened freely. Intra-oral packing was introduced and the external wound was closed with silk sutures.

This patient was observed carefully for some time. It was felt that reformation of scars might necessitate an intra-oral operation and skin grafting, but this did not prove necessary and the patient has a practically normal jaw function at the present time.

The patient was last seen December 7, 1937. The function of the mouth seemed adequate. No handicap in masticating food was present. A rather marked depression was present in the right parotid region due to atrophy of the parotid gland from irradiation and absence of the head of the condyle. In this case also the lower approach from below the angle of the jaw proved satisfactory.

CASE 5. Ankylosis following injury. Failure of first operation to correct. E. H. female aged 11 years. This patient was first seen July 21, 1935 with the complaint of progressive ankylosis of her jaws of 5 years' duration. At that time she had injured her jaw in a coasting accident. Examination showed only slight retrusion and a partial ankylosis. The excursion of the mandible was one half inch and there was no definite deviation present until the jaw was opened or thrust forward when a slight deviation to the left was visible. After confirmatory roentgen studies the patient was operated on in the usual manner on September 6, 1935 and the immediate results were good. The patient had a 1 inch excursion at this time and for about 2 months longer. At this time gradual diminution of opening began to take place and in a few months her original condition was present. Roentgen studies showed a great increase in bony shadows about the joint since the first operation.

On September 12, 1936 the patient was operated upon again. A large osteomatous process was discovered connected with the coronoid process. This was removed and a more extensive resection in the upper part of the ramus was performed.

Since this second operation function and results have been satisfactory. I am unable to be certain as to why this patient needed a second operation. From the roentgenologic descriptions and studies it seems that considerable regrowth of new growth of bone took place. The best simple explanation might be that the original resection was not sufficiently extensive.

CASE 6. Delayed operation on second joint with no ill effects. G. B. female aged 35 years. This patient had a complete ankylosis of the jaw when first seen December 13, 1928. She stated that she had developed rheumatoid arthritis 4 years previously with multiple joint involvement. Several other joints were practically ankylosed and in the past year her mouth had stiffened until she could no longer open it. The patient was emaciated and in poor general health but it was felt that her nutrition would be improved and that an arthroplasty was indicated. In this case a preliminary forcible dilation had been performed under anesthesia for the purpose of extracting several teeth to improve her mouth hygiene which was dangerously bad.

After x-ray studies, the left joint was operated upon on January 7, 1928 with no unusual complications resulting. In this case an efficient joint resulted with the use of a pedicled superficial fascia flap instead of a fascia lata transplant. Almost 2 years later December 31, 1929 the

right temporomandibular joint was operated upon for ankylosis. Since then the jaw function has been satisfactory.

CASE 7. Correction of complete bony ankylosis and external deformity. W. B. male aged 23 years. At the age of 3 years this patient reports that he had a tooth extracted and that his jaw was fractured at that time. Infection set in which took a long time to clear. Since then progressive limitation of the movements of his jaw developed. The patient had not been able to move his jaw in the last 12 to 15 years. His only method of obtaining nourishment was to take liquids or to force firmly mashed food through an open space from missing teeth. In spite of this handicap he had had no serious disease but he did have frequent toothaches.

Examination showed an unusually well developed and well nourished person. He had a complete bony ankylosis of the temporomandibular joint affecting the left side. The lower teeth on the left side were missing while the right upper and lower teeth were interlocking each other. This interlocking was accentuated by extensive decay of the occlusal surfaces of the teeth. There was present the usual external deformity of the lower half of the face, the mandible being retracted and deviated to the left side. The left half of the mandible was much shorter than the right half (Fig. 14). The x-ray report showed the left temporomandibular joint completely obliterated with a large osteoma involving the neck, the sigmoidal notch and coronoid process of the lower jaw and the base of the zygoma (Fig. 15).

On October 5, 1935 under avertin and ether anesthesia the operation was performed in the usual manner as described in the text. Considerable difficulty was experienced in cutting through the neck of the condyle which had assumed a very large size, almost 1 inch in diameter.

As a postoperative complication there developed temporary paralysis of the facial nerve fibers to the orbicularis oculi and the frontalis. This paralysis lasted about 6 weeks. The patient at the time of his discharge from the hospital on October 13, 1935 was able to open his mouth about one half inch. He was instructed to start using his jaw freely. On October 30, 1935 and November 6, 1935 all the badly decayed teeth were removed (eight in all) thus putting the mouth in a healthy condition. The patient made an unusually good recovery in the following few weeks and he was able to open his mouth to almost normal limits (Fig. 16). His condition was now favorable to planning another operation for the correction of the external deformity.

The patient was sent to the hospital and operated on December 5, 1935. For anesthesia avertin and local anesthesia by mandibular injection of 4 cubic centimeters of 2 per cent novocain supplemented by another 2 cubic centimeters of novocain to the buccal mucous membrane was used. An incision was made over the crest of the left alveolar ridge (where the teeth were missing) extending from the median line to the third molar region. The buccal surface of the mandible was exposed freely, the soft tissues were held back with retractors and with surgical burrs a cut was made through the bone beginning at the retro-molar region diagonally forward and downward to the cuspid region (Fig. 4). A hole was drilled at each end of the separated bones and these were then wired together. The twisted ends of this wire were allowed to protrude through the buccal mucous membrane (Fig. 17). As soon as the patient recovered from the effects of the anesthesia the upper and lower teeth were joined together with intermaxillary wiring in their new position. The purpose of this operation was to elongate the short side of the mandible. The patient was discharged from the hospital on December 10, 1935.

INJECTION OF THE RIGHT STELLATE GANGLION WITH ALCOHOL IN PAROXYSMAL TACHYCARDIA

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ONE of the highest degrees of ectopic rhythm in the auricle is paroxysmal auricular tachycardia. It is usually caused by a rapid, regular production of excitation waves at some point in the auricle. Generally this point is outside the sino-auricular node in a heart free from organic disease. The pace is set by this ectopic focus and it may exist for variable lengths of time. Since the origin of the impulse is abnormal, the course it takes through the auricles is abnormal and consequently an auricular complex on the electrocardiogram will differ from the normal *P* wave. However, the course of this wave through the ventricle will be normal, and therefore the *Q-R-S-T* waves will usually be of normal configuration. It is characteristic of this condition that the rhythm is regular.

Although the condition itself is due to an intrinsic abnormality of the sino-auricular node, it is possible that the irritability of the heart is caused by the extrinsic nervous innervation. Working on this theory Leriche and Fontaine concluded that destruction of the cardiac accelerator fibers from the stellate and upper thoracic ganglia should help in restoring a normal rhythm in such cases of persistent auricular paroxysmal tachycardia. They have reported successful results in 2 cases following bilateral stellate ganglionectomy. One of these two has maintained a normal rhythm for over 4 years.

SYMPTOMS OF PAROXYSMAL TACHYCARDIA

The onset of paroxysmal tachycardia is usually abrupt and without any recognizable initiating factor. The patient has a sensation of cardiac distress without pain. There is usually anxiety and pallor and a cold, clammy sweat appears. The cervical vessels and the precordium throb violently. The rate is regular and rapid, usually between 180 and 240 beats per minute. Whatever rate is present after the attack has started, is usually maintained with but little variation until the termination of the attack. After a period varying from a few minutes to several hours, the attack may suddenly stop. There will be a missed beat and then the rate may change dramatically from

220 to 80 beats per minute, and the patient's appearance returns to normal almost as quickly.

TREATMENT

Treatment is quite varied. The methods that are successful in one case may fail in another. A common procedure is to exert pressure over the carotid sheath, or to use ocular pressure. Vomiting and belching are often of great aid. Intravenous quinidine or calcium have been helpful in some cases. As prophylactic measures, quinidine, digitalis, and parathyroid extract are sometimes successful. Not infrequently medical treatment fails to control the attacks of paroxysmal tachycardia, and these may become so severe that serious congestive failure occurs.

Prevention of such attacks is a difficult problem, and if they are not obviated, any surgical procedure is attended with increased risk. Our personal experience includes a number of patients with a variety of pathological conditions, in whom paroxysmal tachycardia has occurred occasionally. Most of these patients withstood operative procedure as well as any other type. Some of them had attacks of paroxysmal tachycardia after operation, but ordinary methods of treatment relieved them.

However, two of our patients developed this condition after operation with death resulting. These two patients had similar histories. Each one had been subject to moderately frequent attacks, which had never been particularly severe. One had an empyema of the gall bladder while the other had repeated attacks of gall-stone colic. Both were middle-aged women in otherwise good physical condition. Each developed paroxysmal tachycardia, one occurring 1 and the other 2 days after removal of the gall bladder and the condition, while distressing, caused no alarm as the patients and their families were more or less accustomed to having this occur. In each instance, the attacks continued without intermission for 4 days. Congestive failure developed and both died.

CASE REPORT

We wish to present a case report of an apparent cure of paroxysmal tachycardia associated with gall-bladder disease.

manible which would automatically bring the chin forward and give a better symmetry to the face. An incision was made over the crest of the alveolar ridge extending from the retromolar region down to the second bicuspids (the molar teeth were missing). The buccal side of the lower jaw was exposed freely and with a surgical burr the mandible was cut through in a diagonal manner as seen in the diagram. Holes were made through the extreme ends of the disconnected bone with a surgical burr. A brass wire 19 gauge was then passed through these holes and the ends of the wire twisted together. This allowed the left side of the mandible to slide forward for about 1 inch. The twisted ends of the wire were allowed to pierce through the mucous membrane of the buccal cavity. The incision wound of the mucous membrane was sutured and the upper and lower jaws were fastened together with elastic attached to dental splints which had been made at the Harvard University Dental School and cemented over the teeth previous to the operation.

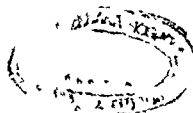
The brass wires were removed 3 weeks following the operation and the jaw consolidated satisfactorily. The improvement of the facial contour following this operation was very gratifying.

Remarks. In an operation of this type one is obliged to disturb the occlusion of the existing teeth more or less but in young patients judicious orthodontic treatment combined

with various types of dental restorations have given satisfactory results (Fig. 24).

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reach the sino-auricular node from this ganglion than from the left

According to White, alcohol injections of the sympathetic ganglia cannot be routinely satisfactory because the injection must be made at a depth of from 5 to 8 centimeters and within 5 millimeters of the nerves to be destroyed. After primary failure, secondary injections are rarely successful. The alcohol, White explains, may at times produce a permanent paralysis of the sympathetic fibers, as contrasted with its transient effect on the peripheral nerves. He describes one patient who received an alcohol injection for angina pectoris, and who had complete relief for over 6 years, another who has been relieved of anginal pain for over 3 years. In other cases there has been a recurrence of symptoms within 6 months. Several were complicated by a severe intercostal neuritis from the alcohol.

ANATOMY

To plan this method of treatment without any guide as to the possible results, a study of the anatomy had to be made. The cervicothoracic or stellate ganglion, the largest ganglion of the sympathetic chain, is composed of a fusing of the inferior cervical and first thoracic ganglia. It is about 2 centimeters long and is dumb-bell shaped. It lies anterior to the head of the first rib near the junction of the vertebral artery with the subclavian. The upper part gives off rami to the three lowest cervical nerves while the lower is connected to the first thoracic nerve by a large and a small ramus communicans.

The bony landmarks for paravertebral injection are the spinous processes, for the tip of each marks the level of the transverse process and the posterior angle of the rib next below. Thus the highest prominent vertebral spine, the seventh cervical, marks the level of the first rib. The points of injection are marked 3 to 4 centimeters lateral to the spinous processes. A spinal puncture needle is inserted at this point, to a depth of 2 to 5 centimeters. The needle should touch the transverse process or the rib. The upper border of the first rib is located, the needle is then inclined slightly in a caudal direction and directed forward at about 20 degrees toward the midline.

Bone should be felt again about 3 centimeters beneath the rib, evidence that the needle is in contact with the lateral aspect of the vertebra, or the head of the first rib. The sympathetic trunk lies at this depth, running along the antero-lateral aspects of the vertebra and over the head of the rib. Any solution injected in this area will diffuse freely through the retropleural areolar



Fig 4 Photograph marked to show point of injection in using alcohol to control tachycardia

tissue, infiltrating the spinal nerves, the communicant and sympathetic rami, and the ganglionated chain. At this state the needle should never be attached to the syringe. Care should be taken that the tip of the needle does not lie within the pleural cavity, in a blood vessel, or in the subarachnoid space. With the needle touching bone, it is almost impossible for its tip to be in the pleural cavity. Before the injection of alcohol, 3 cubic centimeters of 1 per cent novocain should be injected to minimize the pain of the alcohol. Aspiration should always be attempted before injection and a drop of novocain will be aspirated in the needle if the pleura has been entered.

In the event that the ganglion is properly located and injected, there should be evidence of interruption of the sympathetic-parasympathetic balance producing the finding known as Horner's syndrome. Here the pupil contracts, the opening between the lids narrows, the eyeball recedes slightly, ptosis occurs, and sweating is apt to be impaired on the involved side. Other trophic changes may occur later. If Horner's syndrome does not appear, it is evident that the stellate ganglion has not been injected.

On January 4, 1936, our patient, whose severe attacks of tachycardia and gall-bladder colic were continuing, was given an injection of 4 cubic centimeters of alcohol to the right stellate ganglion. This was done during an attack.

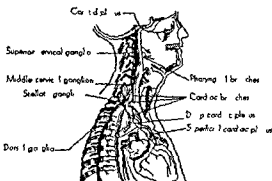


Fig 1 Diagram showing sympathetic nerve supply to heart. Extrinsic nervous innervation is suggested as contributing cause in cases of paroxysmal auricular tachycardia.

The patient, a white woman aged 46 years, was admitted to the Graham Hospital December 30, 1935 following many attacks of paroxysmal tachycardia. According to her history she had suffered from this disorder for the last 20 years, but at the time of admission they were occurring from three to six times a day, lasting from 20 minutes to 2 hours. She had not developed signs of congestive heart failure. Full digitalization, quinine or physostigmine did not improve her condition. During the last 4 or 5 years she had several attacks of gall bladder colic. She stated that since the appearance of the gall bladder trouble her attacks of paroxysmal tachycardia had become more frequent and more severe.

Her symptoms were such that we thought it advisable to remove the gall bladder but feared to attempt it while she was having from three to six attacks of paroxysmal tachycardia every day. Her physical findings were essentially negative. Blood and urine were normal. Blood pressure 140/85 and the heart apparently normal when examined between attacks. There was tenderness over the gall bladder during and between the attacks. X-ray examination revealed a gall bladder filled with stones. Several electrocardiographic examinations gave the usual findings of paroxysmal tachycardia, but showed no evidence of muscle damage when taken between the attacks.

Ordinary medical treatment proved unsuccessful in the control of such an intractable tachycardia. Since this woman was having several severe heart attacks each day it was imperative that we relieve this condition before congestive heart failure might develop. At the time of her first entrance to the hospital we were concerned more with the condition of her heart than with that of her gall bladder. The latter was strictly of secondary importance, although we deemed it wise to remove it if the paroxysmal tachycardia could be controlled.



Fig 3 a Electrocardiogram recording of attack of paroxysmal tachycardia.

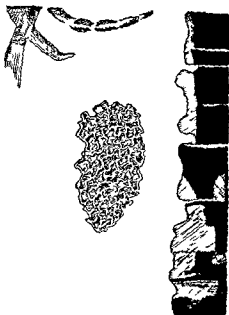


Fig 2 Drawing from roentgenogram of gall bladder. An alcohol injection was used to control tachycardia while the bladder and its contents of stones were removed.

Because of the experiences in the 2 cases previously mentioned, we felt we must be sure of an apparent cure of the heart complication before operating on the gall bladder. Since every means with which we were acquainted had been used unsuccessfully to prevent or control these attacks, we were compelled to consider more radical measures. The work of Leriche and Fontaine indicated that interruption of the path of the sympathetic stimuli through the stellate ganglion might give relief at least for a time. Their method of doing a bilateral ganglionectomy involved a rather formidable operative procedure and had been used in only 2 cases.

We did not feel justified in attempting this, but finally conceived the idea of using an alcohol injection of one stellate ganglion according to the thought suggested by J. C. White, who used it with apparent success in a child who died too soon from other causes to permit the end result to be obtained. This was planned in the hope that it might accomplish some temporary benefit, and that if a partial result was secured the procedure could be repeated upon the opposite side. The right stellate ganglion was chosen because a greater number of the accelerator fibers

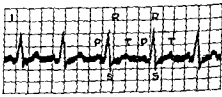


Fig 3 b Electrocardiogram recording for patient subject to tachycardia, showing interval between attacks.

severe and serious congestive failure may take place because of this

2 In these intractable cases of paroxysmal tachycardia, destruction of the accelerator fibers of the heart should help restore a normal rhythm

3 In the case reported, the right stellate ganglion was injected with alcohol and an apparent cure resulted.

4 The patient, $4\frac{1}{2}$ months later, had a cholecystectomy with complete recovery and no fur-

ther occurrence of the paroxysmal tachycardia.

5 A Horner's syndrome resulted in the right eye, which has persisted for nearly 2 years

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- 1 LERICHE, R, and FONTAINE, R Chirurgie du sympathique Rev Neurol, 1929, 1 1046
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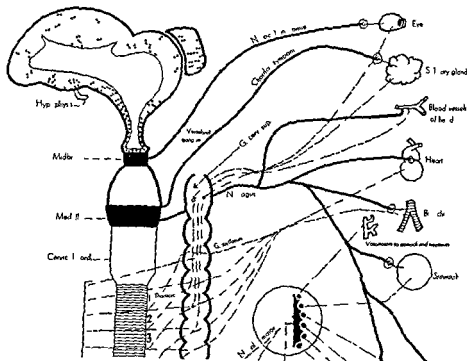


Fig. 5. Anatomy of the stellate ganglion.

of paroxysmal tachycardia which came on just as the local anesthetic was being introduced. Within a very short time the heart beat dropped from 216 beats per minute to a rate of 88. The patient soon developed a Horner's syndrome of the right eye. The injection was accompanied with very little pain, but for the following few days the right shoulder and arm were quite painful and a mild neuritis occurred. This was greatly improved after the 5th month, although occasional pains persisted for a year.

After leaving the hospital 10 days later the patient's general health improved and she was able to leave the house and go on brief shopping expeditions a thing she had been unable to do for the past 2 years. However the attacks of gall stone colic continued. The cardiac relief was so great that she was now very desirous of getting rid of the additional lesion in the gall bladder and so on May 18, 1936, 4½ months later she was again admitted to the hospital. The gall bladder was removed the following day and she made a normal recovery from the operation without any further attacks of tachycardia. Since that time she has been in normal health although Horner's syndrome is still present. Aside from Horner's syndrome the only postoperative complication was the mild neuritis about the right shoulder previously mentioned. During a recent examination this woman stated that she is completely free from both gall bladder and cardiac symptoms. Her only complaint is a sensation of hot flashes due to the menopause. Physical examination was negative. Blood pressure 124/92 and the electrocardiograph normal.

The fact that this patient has had no further heart attacks since the removal of her gall bladder may indicate that this was the actual cause of her

tachycardia but against this possibility is the history of 15 years of tachycardia, before the gall bladder symptoms occurred and the 4½ month interval between the injection and the gall bladder removal. During this time she had no tachycardia but had several severe attacks of gall stone colic. The rather spectacular change from 216 to 88 beats per minute following the injection could have occurred independently of this cause but the fact that the attacks of paroxysmal tachycardia remained absent for the first time in 20 years seems to indicate that this procedure was the actual cause of such improvement.

Naturally a one case report does not prove a great deal, but since the result seemed to be so successful and since there were no real untoward symptoms we feel that the idea of alcohol injection is justified. If further experience provides even a fair number of successful results such a method of interruption of the cardiac accelerator nerves may have a field in the control of this distressing condition and it will be indicated particularly in patients requiring other major surgery.

SUMMARY

1. Paroxysmal auricular tachycardia at times cannot be controlled by medical therapy and a

severe and serious congestive failure may take place because of this

2. In these intractable cases of paroxysmal tachycardia, destruction of the accelerator fibers of the heart should help restore a normal rhythm

3. In the case reported, the right stellate ganglion was injected with alcohol and an apparent cure resulted.

4. The patient, $4\frac{1}{2}$ months later, had a cholecystectomy with complete recovery and no fur-

ther occurrence of the paroxysmal tachycardia.

5. A Horner's syndrome resulted in the right eye, which has persisted for nearly 2 years

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By internally rotating the limb about 20 degrees the plane of the femoral neck becomes horizontal and parallel to the operating table. All we need do then is to use our two fixed points as a guide and keep the pin or wire parallel to the operating table (2). Should we wish to use several wires we plot them individually on the guide. A terminal anteroposterior roentgenogram is then taken with the fixation and guide *in situ*. A final lateral view is also taken as a check-up.

This method is equally applicable for Smith-Petersen nails, Kirschner wires, Moore pins, or any other type of internal hip fixation. Since the holes are spaced one-quarter inch apart the guide may also act as a gauge in determining the length of the nail that is to be used. It is very advisable to use a tunnel cassette holder in taking anteroposterior hip roentgenograms so as to jostle the patient as little as possible in taking the films. This will prevent dislodging the guide.

SPECIFICATIONS

Metal Surgical steel or duralumin
 Long arm Length, 9½ inches, width, ½ inch, thickness, 3/32 inch
 Short arm Length, 6½ inches, width, ½ inch, thickness, 3/32 inch
 Perforations ¼ inch apart, with every fourth perforation a large one
 Diameter of large perforations 3/16 inch
 Diameter of small perforations 3/32 inch

The arms are joined at one end by a rivet. When not in use the guide folds up flat and may be carried in the pocket.

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- 2 SMITH-PETERSEN, M. N. Treatment of fractures of the neck of the femur by internal fixation. Surg., Gynec. & Obst., 1937, 64: 287.

A SIMPLE FIXATION GUIDE FOR FRACTURED HIPs

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IT is an axiom of geometry that 'two points determine a straight line'. With this as a basis I wish to describe a very simple device which is fastened to the front of the thigh and acts as a guide for the insertion of either wires, nails or pins in fractured hips. The author owes a very definite inspirational debt to Mr R. Watson Jones of Liverpool for a fascinating lecture along these lines which he delivered at the American Medical Association convention in Atlantic City in June 1937 (1).

The guide consists of two flat arms of surgical steel joined at one end by means of a rivet. Each

From the Hopital for Joint Diseases and The New York City Hospital

arm is perforated with drill holes spaced one quarter inch apart, with a larger hole to mark off the inches (Fig. 1). The fractured hip is first reduced. Then the guide is placed on the front of the upper thigh with the long arm approximately parallel to the shaft of the femur. The upper angulated end is somewhat below the anterior superior spine. The short arm runs downward and inward at an angle of about 30 degrees. If kept medial to the femoral artery the guide crosses the neck of the femur. The guide must be fastened to the skin with several sutures or towel clips. Adhesive will not do. An anteroposterior roentgenogram of the hip is then taken with the guide fastened in place. From this plate (Fig. 2) we are able to plot the directional line for the insertion of internal fixation. Line A-B on Figure 2 illustrates this idea.



Fig. 1. Photograph of the guide. The short arm revolves 360 degrees and when not in use the instrument may be carried in the pocket as a flat piece of steel.

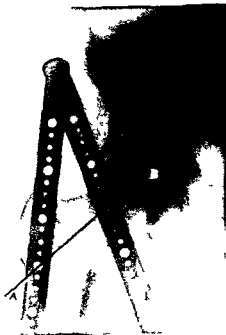


Fig. 2. Roentgenogram of a hip with the guide in place. It is preferable that the guide cross the neck rather than obscure the head as this might hide the tip of the pins or screws and thus create doubt as to the depth of penetration. The superimposed line A-B suggests a possible directional line for internal fixation.

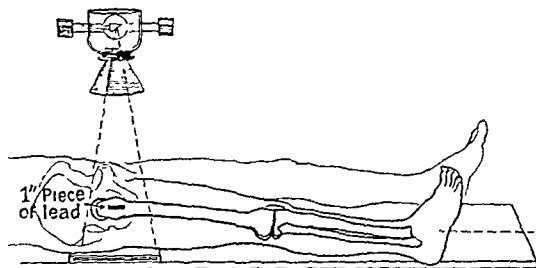
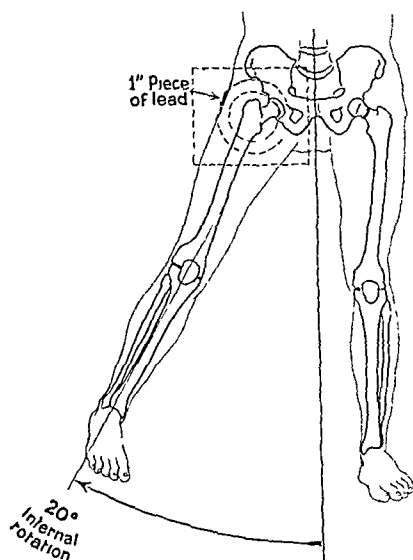


Fig 2 Illustrating position of extremity for anteroposterior x-ray. Note placement of 1 inch lead piece

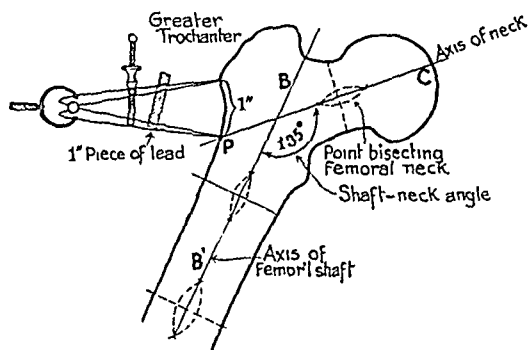


Fig 3 Determination of "shaft-neck angle" From tracing of anteroposterior x-ray film

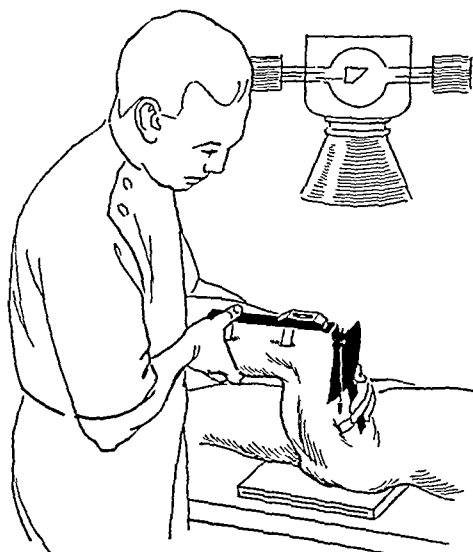


Fig 4 Extremity in position for lateral x-ray exposure. Note application of inclinometer which insures right angles at hip and knee, horizontal tibia, and correct amount of abduction

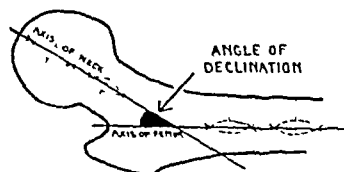


Fig 5

Fig 5 Determination of angle of declination From tracing of lateral x-ray film

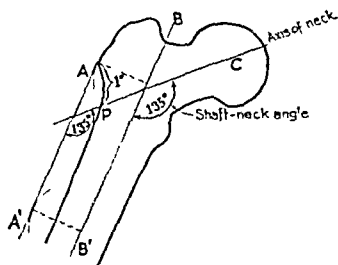


Fig 6

Fig 6 Locating base line, 1-1', for nail guide

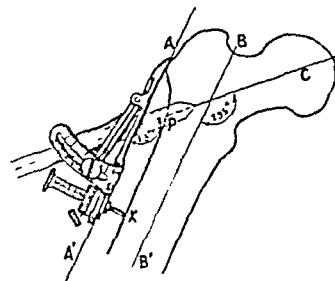


Fig 7

Fig 7 Locating the stud point, X. Note base of "nail guide" parallel to 1-1', instrument set at desired angle and nail overlying neck axis

FRACTURE OF THE FEMORAL NECK

A Rapid and Accurate Method of Internal Fixation Using a Flanged Metallic Nail

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INTEREST in fracture of the neck of the femur was greatly stimulated in 1931 by Smith Petersen's article on internal fixation by means of a flanged metallic nail. The technique, as originally described by him, necessitated the following: (1) large anterior incision, (2) arthrotomy, (3) open reduction, (4) second incision over the trochanter, (5) insertion of nail, (6) impaction of fragments.

This procedure as can be readily appreciated was time consuming and subjected elderly people to extensive surgery. As a result, the so called 'blind pinning' came into vogue and articles describing numerous methods and instruments for this procedure have been published. Most of these methods are in reality not 'blind pinning' at all since after the nail is started into the bone roentgenograms anteroposterior and lateral, are taken to determine whether or not the position of the nail is correct. This latter procedure not only prolongs the operation but greatly increases the danger of contamination.

A technique, here described, has been devised by which a flanged nail can be inserted accurately and rapidly into the head and neck of the femur *provided a reduction is obtained*.

The operative procedure takes approximately 15 minutes and is not shock producing. This technique has been used on more than 40 cadavers and on 15 living subjects without failure. The

experimental and operative work has been done at the Reconstruction and Mornasana Hospitals of New York.

TECHNIQUE

Procedure on admission. When a patient with a suspected fracture about the hip joint is admitted an anteroposterior roentgenogram is taken to determine its type, i.e., whether it is subcapital, transcervical, pertrochanteric, or intertrochanteric. We believe that subcapital and transcervical fractures are best treated by internal fixation. Pertrochanteric and intertrochanteric fractures, without comminution, may also be pinned. If internal fixation is elected Russell traction is applied to the injured extremity in moderate abduction 5 to 8 pounds of weight being used. This type of treatment varies from 24 hours to a week or more depending upon the patient's general condition.

In our experience, this preliminary traction in moderate abduction makes subsequent reduction easier to accomplish and gives sufficient time to get these patients in the best possible condition for operation. It also acclimatizes them to their changed status.

Pre operative determinations. Special anteroposterior and lateral roentgenograms of the head and neck of the *uninjured* femur are taken with the tube centered over the neck. These films are used for subsequent mensuration on which is based our operative procedure. Complete details and explanation may be found in a previously published article (1).

Technique of taking anteroposterior roentgenogram. 1. A piece of lead 1 inch long incorporated in a strip of adhesive is applied directly lateral to the greater trochanter of the sound femur and parallel to the cassette.

2. The extremity is moderately abducted and internally rotated through 20 degrees (Fig. 2).

An exposure is then made.

Technique of taking lateral roentgenogram. From a tracing of the anteroposterior x-ray film the shaft neck angle is determined as follows (Fig. 3).

The axis B B' of the femoral shaft is drawn. The point P is marked 1 inch below the most

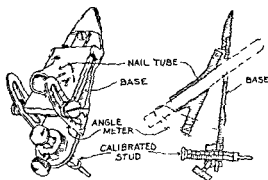


Fig. 1. Nail guide.

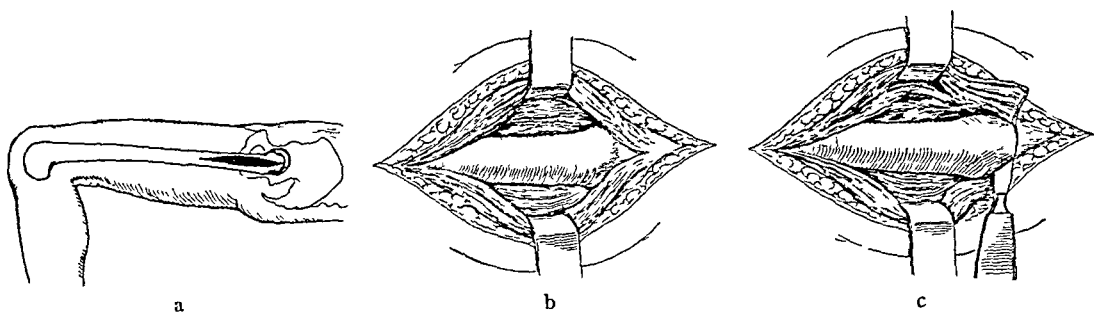


Fig 11 a, b, and c Illustrating incision and exposure of upper end of femur

$A-A'$ is measured This represents the *length of the stud* necessary to hold the base of the guide parallel to the shaft axis $B-B'$

4 The distance is determined with dividers from the point of nail entrance P to the contact point X ($P-X$ distance) This is the distance below point P , at which a hole is drilled through the cortex for reception of the stud point (Fig. 7)

5 The length of the neck axis $P-C$ and the image of the one inch lead are measured on the tracing (Fig 8) The actual length of the neck axis $C-P$ is determined by direct proportion From this calculated length is subtracted one-half inch (one-quarter inch for impaction and the other one-quarter inch leeway from the articular cartilage) and a nail is selected of this length

Example Image of neck axis Image of 1 inch piece of lead X (actual length of neck) 1 inch
 4 inches $1\frac{1}{8}$ inch X 1 inch
 $\frac{20}{9}$ inches = X

$X = 3.55$ inches (actual length of neck)

Length of pin to use = 3 inches (3.55 inches minus $\frac{1}{2}$ inch)

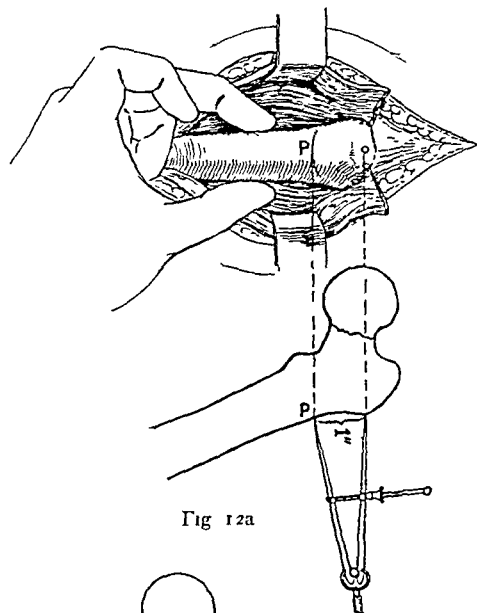


Fig 12a

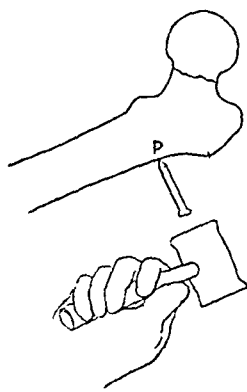


Fig 12b

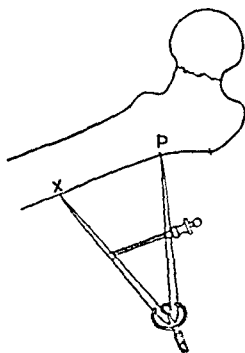


Fig 12c

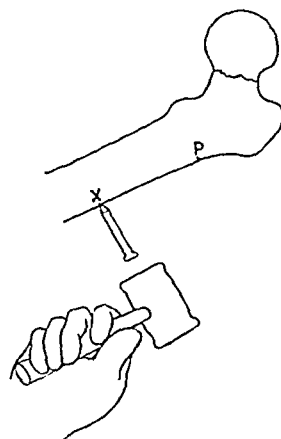


Fig 12d

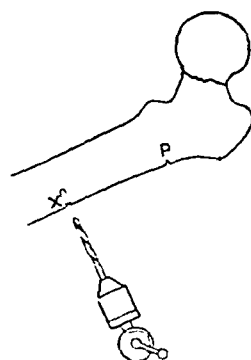


Fig 12e

Fig 12 a, b, c, d, and e Locating points P and X on the lateral aspect of the femoral shaft, for introduction of nail and "stud"

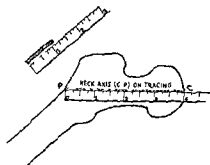


Fig 8 Measurement of neck axis CP and image of 1 inch piece of lead

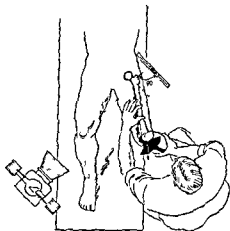


Fig 9 Illustrating position of extremity after reduction and method of taking lateral x ray film

prominent portion of the lower part of the greater trochanter. A point is found which bisects the middle of the femoral neck. A line CP is drawn through this point and the point determined above. Where it crosses the axis of the shaft, it forms the shaft neck angle (Fig 3).

With a little experience this angle can be adequately determined with a transparent protractor on the wet plate. Then, with the patient supine (1) flex the hip and knee to 90 degrees in the sagittal plane (2) abduct the thigh the difference in degrees between the shaft neck angle and 90 degrees (Example—shaft neck angle 130 degrees minus 90 degrees equals 40 degrees therefore, abduct 40 degrees).

At this point, the tibia must be kept horizontal and the hip and knee at right angles. This procedure is facilitated by an instrument known as the Caldwell Glass inclinometer (Fig 4). An exposure is then made with the tube centered over the neck. These preliminary x ray films may be taken at any time prior to the operation.

MEASUREMENT OF X RAY TRACINGS

1. The angle of anterior declination of the neck of the femur is then determined in the following



Fig 10 Illustrating correction for minor posterior displacement of the head by changing the amount of internal rotation. a Center line of neck is horizontal after internally rotating femur the same number of degrees as the angle of declination. b Minor posterior displacement of head. Note center line of neck though horizontal does not pass through center of head. Deviation of central axis of head from central axis of neck is the number of degrees

manner. On a tracing of the lateral x ray draw the axis of the femur. The axis of the neck is determined by a point in the center of the neck and a point in the center of the head. Intersection of these axes is the angle of declination (Fig 5).

2. The shaft neck angle has been determined previously from a tracing of the anteroposterior x ray film (Fig 3).

3. Upon this same tracing a line $A A'$ is drawn parallel to the femoral shaft axis $B B'$ from the most prominent point of the lower portion of the greater trochanter (Fig 6). This line is crossed by the femoral neck axis forming an angle equal to the shaft neck angle. With the nail guide set at this calculated shaft neck angle, the base of the guide with a pin *in situ* is placed parallel to the line $A A'$ so that the nail lies directly over the neck axis CP . The contact point where the calibrated stud crosses the lateral border of the femoral shaft tracing is marked X (Fig 7). The distance from this contact point X to the line

necessary for correction. c Correction for minor posterior displacement of head. Decrease the amount of internal rotation of the femur the estimated number of degrees necessary to bring central axis of head horizontal. Therefore when nail is driven in horizontally it will enter the center of the head. It is to be noted that the converse of the above is true for the minor anterior displacements of the head.

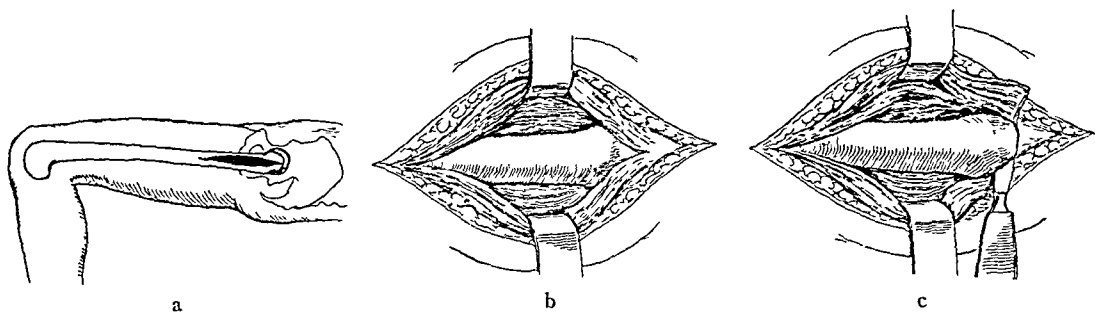


Fig 11 a, b, and c Illustrating incision and exposure of upper end of femur

A-A' is measured This represents the *length of the stud* necessary to hold the base of the guide parallel to the shaft axis *B-B'*

4. The distance is determined with dividers from the point of nail entrance *P* to the contact point *X* (*P-X* distance) This is the distance below point *P*, at which a hole is drilled through the cortex for reception of the stud point (Fig 7)

5 The length of the neck axis *P-C* and the image of the one inch lead are measured on the tracing (Fig 8) The actual length of the neck axis *C-P* is determined by direct proportion From this calculated length is subtracted one-half inch (one-quarter inch for impaction and the other one-quarter inch leeway from the articular cartilage) and a nail is selected of this length

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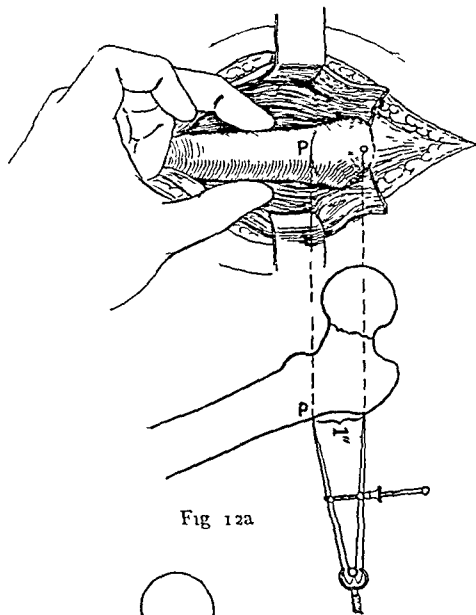


Fig 12a

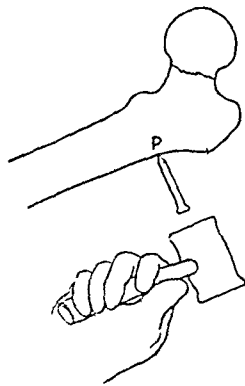


Fig 12b

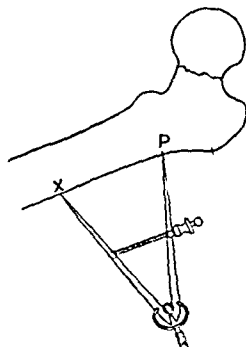


Fig 12c

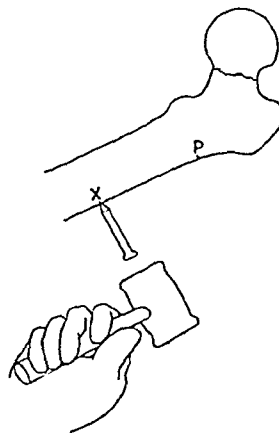


Fig 12d

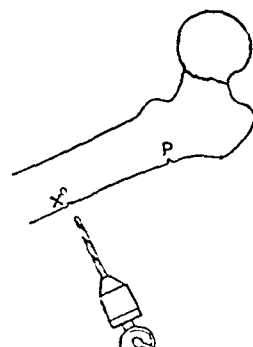


Fig 12e

Fig 12 a, b, c, d, and e Locating points *P* and *X* on the lateral aspect of the femoral shaft, for introduction of nail and "stud"

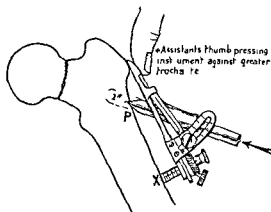


Fig. 13 Nail guide applied to bone and nail driven through cortex

By having the nail entrance 1 inch below the most prominent point of the lower portion of the greater trochanter and at the determined shaft neck angle, the ideal position for the nail is insured, that is (1) valgus position of the nail, (2) nail in the mid portion of the neck and head, (3) point of the nail extending practically to the articular cartilage

METHOD OF REDUCTION X RAY CONFIRMATION OF REDUCTION AND OPERATION

Step 1 Operative field which extends from the crest of ilium to the knee is given bone preparation which consists of (a) shave (b) scrub with

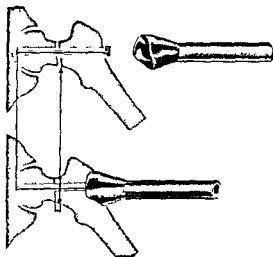


Fig. 15 Method employed for impacting of fragments

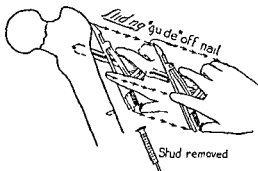


Fig. 14 Method of removal of nail guide Note stud first removed and instrument slid off

soap and water, (c) alcohol (d) benzine, (e) ether, (f) 3 per cent iodine, (g) iodine saline wet dressings for 24 hours (1 dram of tincture of iodine to a pint of salt solution)

Step 2 Anesthesia, spinal or local

Step 3 Reduction according to Leadbetter method

Step 4 X ray confirmation of reduction

The Caldwell Glass inclinometer is then applied so that the plumb-bob is over the tibia. An assistant maintains reduction with (a) thigh parallel to table (b) knee flexed to a right angle (c) femur internally rotated the number of degrees of the previously calculated angle of anterior declination. This amount of internal rotation is determined from the inclinometer. (If the angle of declination is found to be 20 degrees then rotate extremity internally 20 degrees)

As the assistant is the most important man of the team it is essential that he have his hands free to manipulate the extremity. Therefore the foot of the patient rests on his knee and he has no weight to support with his hands

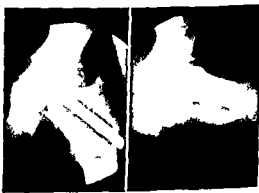


Fig. 16 Anteroposterior and lateral roentgenograms showing nail in situ

An anteroposterior x-ray film with the tube centered directly over the neck of the femur is taken. Next, a lateral roentgenogram perpendicular to the neck with center ray horizontal (parallel to the table) is taken. The technique of taking this lateral x-ray film is as follows (Fig 9).

A A cassette is placed approximately opposite the crest of the ilium, with its top edge level and its face vertical, so that it lies parallel to the neck of the femur. (We bend a jointed carpenter's rule so that it makes the shaft-neck angle and lay it with one arm parallel to the shaft of the femur and the other arm overlying its neck. Placement of the cassette parallel to this neck arm is then apparent. The cassette is made level by means of a "spirit level" placed on its top edge.)

B The tube is placed on the opposite side of the table, beneath the flexed thigh of the good leg and must be at the same height as the femoral neck. Its center beam is made perpendicular to the cassette and, therefore, perpendicular to the neck.

An exposure is then made.

The anteroposterior and lateral exposures are then examined as to the accuracy of reduction, and if they are found unsatisfactory, reduction is repeated. Corrections for minor errors in the anteroposterior plane may be added to or subtracted from the calculated shaft-neck angle so as to bring the point of the nail into the center of the head. When the neck of the femur is found to be parallel to the edge of the x-ray film in the lateral view, the neck obviously must be horizontal. Therefore, the thigh is being held correctly as to internal rotation. If the neck is not horizontal, the error can be corrected by adding to, or subtracting from, the number of degrees of internal rotation of the thigh as read on the Caldwell-Glass inclinometer. Likewise, correction for minor displacement of the head in relation to the neck can be corrected in the same manner (Fig 10).

Step 5 Operative procedure With the Caldwell-Glass inclinometer still in place and the femur maintained in the stated or corrected amount of internal rotation, the operative site is iodinated and draped. An incision is made on the lateral aspect of the thigh, beginning over the greater trochanter and extending downward in the long axis of the femur, approximately 5 inches. This incision is best made by exposing the bone with one stroke of a large knife. We have found this far more satisfactory than going down layer by layer, as for some reason or other, when our incision is made, the vastus lateralis retracts beneath the fascia lata. No important blood vessels are encountered and it is unusual to tie a ves-

sel. The superior attachment of the vastus lateralis is detached from the superior portion of the greater trochanter. A fairly good sized blood vessel is invariably encountered during this procedure and it should be immediately clamped and ligated. Ordinarily, this is the only vessel that requires ligation. The next step is the freeing of the muscular attachments from the posterior aspect of the trochanter and the upper 2 inches of the femur. This is done with one stroke by inserting the blade of the knife adjacent to the posterior surface of the upper end of the femur and continuing the incision behind the trochanter (Fig. 11). Any remaining attachments of the muscle to the lateral aspect of the bone are bluntly dissected off with a piece of dry gauze.

The most prominent point on the lower portion of the greater trochanter is then palpated and the lateral border of the shaft is scored *1 inch below this point* with a divider set at this distance. A maximum valgus position of the nail is desirable. One inch below the trochanter has been found to be the lowest practical point for insertion of the nail, because below this point the cortex is dense and thick and will shatter when the nail is driven in. This shattering of the cortex prevents a firm grip on the flanges and will permit rotation of the nail.

The center point of the lateral surface is then determined on this line 1 inch below the greater trochanter, and a punch hole is made at this point. At this time, one should check with the assistant who is holding the leg to see that the stated amount of internal rotation is being maintained.

One arm of a divider, which is set at the predetermined *P-X* distance is placed in the punch hole *P* and then the lateral border of the femur at point *X* is scored. This marks off the distance from the point of insertion of the nail to the stud point of the nail guide. The punch hole is then made in the center of this arc so that indentations *P* and *X* are on approximately the same level. A one-eighth inch drill hole is then made through the cortex (Fig 12).

The nail guide set at the proper angle and the stud at the determined distance are now applied to bone as follows.

The "stud point" is placed in the drill hole. It will be found that the nail point enters the punch hole *P*. The superior portion of the instrument base rests on the trochanter and is held firmly against the bone by an assistant. The nail is then driven through the cortex (Fig 13). The stud is removed and the instrument is *slid off* the nail (Fig. 14). In this step, one should be

most careful not to disturb the direction of the nail

At this point, it is essential that the assistant who is holding the extremity should recheck the amount of internal rotation. A spirit level is then placed on the nail and the latter adjusted until it is horizontal. Check again with your assistant prior to driving in the nail. The nail is then driven in the full length. The impactor is applied to the lateral surface of the femur, over the head of the nail and the fractured surfaces jammed together with three or four heavy blows (Fig 15). During the impaction, if the nail backs out it is to be driven in and then reimpacted. The assistant who is holding the leg may now relax and the inclinometer can be removed. The wound is closed in layers, and care is used to be sure to obliterate the dead space posterior to the trochanter. A sealed adhesive dressing is then applied (Fig 16).

AFTER TREATMENT

The patient is returned to bed without external immobilization. Movement of the extremity is encouraged from the beginning. The patient is allowed out of bed in a wheel chair as soon as he is able to sit up, usually within a week. Crutches are allowed when the patient is able to handle them, which is frequently as early as 7 days. Check up roentgenograms may be taken at any time that is convenient.

GENERAL CONSIDERATIONS

The time for the patient to bear weight on the injured extremity we believe, depends upon the reduction obtained. In our opinion, the ideal position for the head in relation to the neck for weight bearing is one in which the head is superior and slightly anterior. This superiorly and anteriorly placed head with its increase in valgus brings the center of weight more directly in line with the femoral shaft. When we have obtained this position, we have no hesitancy in allowing immediate weight bearing, as the head tends to impact itself on the neck in the axis of the pin. We have also observed that when the head is slightly anterior to the neck the patient walks with the extremity in practically the normal posi-

tion, whereas, when the head is slightly posterior in relation to the neck, the extremity is invariably rotated externally and the spine hyperextended. If we should get a "varus position" full weight bearing is deferred until we believe that solid bony union exists. We have noticed that a large number of these fractures which have gone to what we consider solid bony union, first absorbed a portion of the neck of the femur. This fact has so impressed us that we have even considered operative resection of a portion of the neck before internal fixation. We believe that the continuous impaction of weight bearing in the so called "ideal position" (which is essentially in the axis of the neck and pin) maintains close apposition of the fragments, regardless of the amount of absorption.

The increased density along the fracture line which is usually referred to as callus, is in reality eburnated bone and indicates non union. The fractures which have gone to bony union, as proved clinically, and on which we have repeated x ray check ups, show no increased density at the fracture line but a gradual reestablishment of the trabeculae.

End result estimation as to bony union is worthless under 2 years.

At the present time, we are using a modified Smith Petersen nail made of Vitalium (4). To date we have no definite criteria as to the time for removal of the nail.

These comments are not to be interpreted as conclusions, but merely as preliminary observations based on our experience in 50 cases in which various methods of fixation with nail were used during the past 3 years.

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PITFALLS IN SURGERY

PROBLEMS IN THE SURGERY OF THE THYROID GLAND

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IN surgery of the thyroid gland the greatest chance for error lies in the selection of the procedure to be used

If the thyroid disease is complicated by the presence of diabetes and the patient has been under treatment for diabetes, the tendency is to mistake an apparently safe condition for one that is really unsafe. If in the diabetic patient the gland to be removed is greatly enlarged or if the patient has active hyperthyroidism, the allowance of a few extra days beyond the time when the patient seems ready is a good precaution, a diabetic patient is never as good a risk as he seems to be even if all the criteria appear to justify operation

In thyroid surgery, the mere factor of age, independent of all other considerations, may tempt the surgeon to do too much. In older patients, say from 75 to 85 years of age, a house officer may routinely order a hypodermic injection of morphine for pain or restlessness and be surprised that the patient enters into his final sleep. In very young patients, especially if hyperthyroidism is present, a large dose of morphine may be required to produce a clinical effect because active hyperthyroidism oxidizes morphine

When there is an obstruction to respiration, even if cyanosis is only slight, operation should be performed with the most perfect local anesthesia and with the most meticulous care in securing hemostasis. The administration of any narcotic and the use of inhalation anesthesia are contra-indicated, narcotics or inhalation anesthesia will push such a patient beyond the margin of safety by depressing the internal respiration, thus forcing the surgeon to perform an emergency operation

When the growth is intrathoracic with one very large lobe extending deep into the chest and pressing the trachea far to the opposite side and against a smaller lobe, the goiter is apt to compress the trachea to the danger point of interference with exchange of air. The patient is then apprehensive, nervous, and restless. In such a case the use of general anesthesia and of nar-

cotics is a hazard, it is sometimes far better to employ local anesthesia. Great care must be used in the approach as well as in assuaging the patient's fears, for both fear and pain increase metabolism, hence increase the probability of a rapidly oncoming asphyxia. The difficulty of the situation always is that pain and fear must be controlled and at the same time depressants and narcotics must be avoided. Reliance, therefore, must be placed upon supporting the morale of the patient and quieting his fears while painless dissection of the lesser lobe is carried out under local anesthesia. Removal of the lesser lobe releases the trachea and allows freer breathing. The entire picture is changed at once, and it is at this point that the surgeon can recast the scene. Under certain conditions, however, further operative steps may be deferred until the patient's health is well restored

In these critical cases the use of a very light analgesia by means of nitrous oxide and oxygen is advantageous, in addition the staff should be prepared to force oxygen if a crisis of asphyxia develops

As to the cosmetic question, the skin incision should be made to run parallel to the folds of the skin and so high in the neck that the scar will not descend and finally come to lie upon the sternum where it would be conspicuous. The so called necklace incision too frequently finally becomes stabilized on the sternum, but a scar lying among the natural folds of the neck has been found to be unnoticeable

In the exposure of a goiter, it is important for two reasons not to divide the muscles transversely: first, a transverse incision of the muscles divides the motor nerves and, second, division of the motor nerves is followed by complete atrophy of the muscles with a permanent disfiguring recession in the neck above the clavicle. Finesse will avoid permanent disfigurement. The best method to follow is (1) to use a long vertical incision from the top of the larynx to the sternum, (2) to divide the attachments of the sternothyroid muscle. After the incision has been made

and the sternothyroid muscle has been divided, the goiter will lie exposed.

The surgeon may now be tempted to displace the goiter from its bed out into the field by an apparently simple movement. Once this maneuver has been started the surgeon may find the upper pole of the goiter projected behind the larynx lying deep in the neck between the larynx and esophagus. In such an emergency the surgeon should introduce his fingers underneath the goiter until the finger tips gain control of the goiter at its deepest point. By manipulation he may then roll out the entire goiter, extracting it from the deep recess it occupies. If the extraction is immediately followed by stridor, the surgeon is aware that the recurrent laryngeal nerve has been paralyzed—usually permanently.

In some patients the goiter may not be large but more of it may lie behind the larynx and trachea than in front of it. This happens more often in men than in women, for the reason that the muscles in the neck of the male are stronger than those in the neck of the female, and therefore, following the line of least resistance, the growth is forced into the deeper parts of the neck. In these cases, as in the case of a deeply lying goiter, the surgeon may be beguiled into following the goiter and rolling it out when, as just described, as the gland is about to be delivered into the field, stridor develops—an indication that paralysis of the recurrent nerve has occurred.

If the goiter is intrathoracic and extends deep down into the chest the surgeon may be beguiled into passing his finger tips in so as to control the goiter, the attachment of the goiter being still intact as the surgeon draws the goiter out there may be a great rush of blood from torn vessels into the deeper recesses of the neck.

These are examples of pitfalls in surgery of the thyroid gland caused by the use of force instead of finesse.

Let us now see how these pitfalls may be avoided.

First, dissection should be carried bloodlessly along to the attachments of the goiter to the larynx and then bloodlessly to the upper pole of the gland. The attachments of the goiter to the larynx should then be divided between hemostats thus making easier the approach to the superior pole where, between forceps, a bloodless division should be made of the superior pole without any force whatsoever having been used to dislocate the lobe.

Dividing the points of attachment, now here now there, the surgeon finds that in due course the goiter will deliver itself from the deepest

recesses, whether from the thorax, or behind the larynx or trachea, with the utmost smoothness.

We have already mentioned that the extraction of an intrathoracic goiter by force presents a pitfall. This danger can be avoided by bloodless dissection. The attachments of the goiter should be completely divided and by meticulous care the capsule of the adenoma that goes down into the chest should be separated. The cleavage line should be followed all the way down until the adenoma can be freed from the slight cohesion to the surrounding tissue. Then when all attachments have been freed and when all the vessels have been divided and tied we see the intrathoracic goiter all but extruding itself by the patient's respiratory movements.

An intrathoracic adenoma of this type may have so meager a blood supply as to threaten necrosis. To avoid this complication Nature may have thrown out innumerable capillaries to draw blood from the outer capsule. The easy separation of these innumerable capillaries causes momentary oozing from every point, but light gauze packing will quickly arrest such oozing. The packing should be left in place while other details of the operation are attended to. It will be found then that the oozing has stopped in a fashion analogous to the spontaneous arrest of bleeding in childbirth. When the gauze packing is removed, preparatory to closing the wound, it is well to insert the hand into the bottom of the sac, for a clot of blood will always be found here. If this residual clot of blood is overlooked protracted drainage will ensue.

After the sac is cleansed a square of iodoform gauze should be wrung out of salt solution and spread over the mouth of the sac, and pressed down to its very bottom by the hand to make certain that the bottom has been reached. This step will insure against further oozing as well as against infection. After several days the gauze packing should be removed cautiously and gradually. This cautious maneuver will obviate one of the most serious pitfalls in goiter surgery, that is, mediastinal hemorrhage and mediastinal infection.

Postoperative mediastinal hemorrhage is the result of carrying the dissection outside the inner capsule of the thyroid thus lacerating some small vessels in the mediastinum, which small vessels are not endowed with the mechanism required for clotting. The danger is apparent that this slow oozing may continue indefinitely filling the mediastinum and finally destroying the patient.

It sometimes happens that the growth of the

goiter after it has descended into the chest is so extensive that it cannot be extracted whole. By the complete severing of the attachments of the thyroid and absolute control of bleeding, by the identification of its capsule, by finding the cleavage line between the capsule and the surrounding tissues, the surgeon may remove the goiter piecemeal, no matter how deep down in the thorax. I recall one case of a huge adenoma displacing heart, huge blood vessels, and even liver, yet the growth was removed piecemeal, without special difficulty, and the patient made a good recovery.

Another danger is presented when a large goiter occupies the deep recesses of the neck on both sides and the left and right lobes are joined together across the trachea by a goitrous bridge. The growth on each side so presses against the trachea that its lumen becomes narrow and is so compressed that a so called saber sheath trachea is formed. The caliber of the trachea is so reduced that respiration is labored and an increasing cyanosis of the nails and lips develops. In such a case a most precise, painless dissection with reflection of the flaps, and a precise and painless transverse division of the muscles overlying the right, the left, and the middle lobes, should be made. In many cases the easy exchange of air will follow this procedure. Moderate asphyxia may still continue, and, in order to gain control of the goiter, the surgeon may be tempted to pass his fingers down underneath a large lobe. As he begins to raise the goiter out of its bed, the trachea, already compressed by the goiter to the limits of safety, may be so completely obstructed that a crisis of asphyxia may be precipitated, and to the crisis of obstruction, there is added the crisis of a rushing hemorrhage. This rushing hemorrhage is caused by back pressure and wide distention of the veins, large distended veins are always present over the surface of a large goiter and their walls are not only thin but are stretched and thus are easily torn. In the midst of the crisis of asphyxia from obstruction, therefore, in rolling out the goiter these veins are easily torn. The gushing blood, of course, must be arrested or there will be death from hemorrhage. The obstruction of the trachea must be relieved or there will be death from asphyxia.

To avoid this pitfall, the following procedure is suggested.

After the vertical and transverse division of the muscles is made, a bloodless dissection will expose the entire goiter, above, below, and laterally. Then it will become apparent to the surgeon in which direction the goiter may be painlessly extracted. If pain is produced, metabolism

will be increased, and increased metabolism may precipitate the crisis of asphyxia.

One of three choices usually presents itself: (1) A bloodless division of the isthmus, down to the laterally compressed trachea. Usually this procedure releases the lateral pressure on the trachea, and the operation may then be pursued leisurely. (2) If one lobe is smaller than the other, and if by finesse a bloodless dissection will free the upper, or the lower, or the lateral attachments of this lobe, enough relief of the lateral pressure will be given to secure a good exchange of air. The bloodless, painless dissection, made sometimes from below, sometimes from above, finally frees the pole of one side or both sides, and the great mass of goiter may be eased up out of the bed of the wound sufficiently to free the obstruction.

Obviously, the first objective is to free the threatening obstruction. From this point on, provided there has been no hemorrhage, the operation is completed in the usual manner. In some instances the goiter may be removed as is the saddle from a horse. It is finesse, not force, that brings success. Should the surgeon be forced to do an emergency tracheotomy amid bleeding caused by venous back pressure associated with asphyxia, and should there not be time to catch and tie all of the bleeding vessels after the tracheotomy is made, the head of the patient should be lowered and the catheter attached to a suction apparatus should be slipped deep into the trachea so that the blood can be sucked out. The extent to which the respiratory tract can be freed of blood—and by this mechanism it can be freed of blood—is of prime importance in diminishing the probability of postoperative pneumonia.

In operations for hyperthyroidism, especially in bad risk patients, the following fact should be borne in mind: if the bad-risk patient is sent to the operating room and placed upon the operating table, draped ready for operation, and is then returned to her room, this procedure alone, with no operation whatever, will entail a mortality rate.

If a bad risk patient is quietly given inhalation anesthesia for 20 minutes in her bed, without any operation whatsoever, there would be a definite mortality.

If a bad risk patient is taken to the operating room and given inhalation surgical anesthesia for 20 minutes, the mortality would be higher than the sum of the mortalities in the first and second instances just cited.

The pitfall presented by these factors of mortality in severe hyperthyroidism can be avoided by performing the operation, under analgesia and

local anesthesia, in the patient's room with the patient in her own bed. This procedure can safely be carried out in any but the *delirious* patient, the delirious patient should never be operated upon, for in him an irreversible chemical breakdown is already in process.

Whether the disease is severe, whether the age of the patient is a factor, whether the patient does not respond to rest and Lugol's solution whether a heart lesion is present whether severe diabetes is present whether the patient be utterly without morale—these factors whether only one or a combination of them be present demand the utmost caution. The pitfall in such a case is that, before operation, a limited objective has been decided upon by the surgeon—a ligation possibly, or a lobectomy—but in the preparation of the patient and in the progress of the operation, he may be so pleasantly surprised by the apparently good condition of the patient that instead of adhering to the limited objective he proceeds to finish the operation—and the patient as well.

It is axiomatic that the scope of the operation previously decided upon, should not be increased during the operation although it may be diminished. Indeed it is always well to remember that the operation can be suspended at any time.

Another pitfall is presented when in the course of operation, the highly nervous patient devoid of morale becomes fretful under analgesia and local anesthesia with a tendency to struggle and the surgeon instead of stopping the operation, with more impatience than judgment has the patient put under complete surgical anesthesia thus precipitating a thyroid crisis.

Another pitfall relates to sedation: a patient semiconscious completely quiet, under amylal avertin, etc.—a condition ideal for the surgeon but not for the patient—may never wake again. Obviously, to overcome this pitfall the use of amylal or avertin except in small doses and in young subjects, should be avoided.

What about the patient from 2 to 10 years of age who has severe hyperthyroidism? Are pitfalls presented by these patients?

In such patients safety lies in the hands of the anesthetist. Miss Adams of our clinic surrounds these hyperkinetic children who are burning with metabolism with a kindergarten atmosphere for days and weeks and even for as long as a month. She has taught them games allowed them to play with the gas machine even to blow up the gas bag until a safe date for the operation can be set by her. We do not operate until Miss Adams believes that she can administer the

anesthetic to the hyperkinetic child in its bed in its room, without causing the child to cry or struggle. The operation then is performed as quickly as possible. Thus carried out the risk is slight. If however the patient is afraid or struggles, the risk is accordingly increased.

A pitfall to be avoided after operation in the case of a bad risk patient with hyperthyroidism is watchful waiting until a crisis has developed for once the uprush of temperature pulse respiration, nervousness, sleeplessness has taken place, it is difficult to regain control. This pitfall can be avoided by treating the patient immediately after operation, not in accordance with the symptoms in the individual case but in accordance with statistical indications. For instance if the patient is 60 years of age, emaciated, feeble prematurely old, looking even older than her years and has only moderate hyperthyroidism, the risk in this patient according to statistics is not good. Therefore although at the close of operation such a patient may appear to be in a surprisingly good condition, according to statistics the probabilities are that difficulties may arise in a patient of her type and she should therefore be given the advantage of being put into an oxygen tent at once, of receiving glucose intravenously and under certain conditions of being given a blood transfusion. If all of this is done in the after treatment of a patient who appears to be in excellent condition after operation almost never will a post operative crisis occur.

The logic of such treatment is analogous to that of being vaccinated against small pox or inoculated against typhoid fever. Statistically vaccination and inoculation are indicated. No one will ever know however whether the protection was needed in any individual case.

Another pitfall is observed in cases in which a most trifling exciting cause may result in death some days after the operation if the dissection has been carried so closely upon the larynx and the trachea as to lay naked the sensory nerves lying upon the surface of the larynx and trachea. The immediate connection of these nerves is with the wall of the larynx and trachea and the underlying mucous membrane as is plainly indicated by the fact that touching the surface of the larynx and trachea causes reflex coughing. The reaction to touching the external surface of the naked larynx and trachea is precisely the same as that which results from the presence of a foreign body in the larynx and trachea.

One reaction to the presence of a foreign body in the larynx and trachea is the secretion of large amounts of tenacious mucus. There irritation of

the surface of the larynx and trachea likewise produces the secretion of large amounts of tenacious mucus. Large amounts of tenacious mucus float back and forth in the trachea and the bronchioles, now and again causing an obstruction of a branch of the bronchial tree. This obstruction may be followed by infection, and infection by mucopus, which may be spread about producing bronchial pneumonia, and bronchial pneumonia may cause death. This pitfall may be avoided by always leaving a covering over the sensory nerves of the larynx and trachea, as but a trifling irritation of the sensory nerves of the larynx and trachea may cause death.

If bronchial pneumonia develops from any cause, the pain and the stiffness of the neck may so interfere with the raising of the mucopus that it not only causes high fever and rapid pulse but interferes with proper ventilation of the lung. As suggested by Dr. George Crile, Jr., in some cases great relief follows the placing of the patient in a head-down position, thus allowing the mucopus to drain out slowly from the mouth and the nose. Following the postural drainage, the temperature will become lower and the patient will improve. This can be repeated as often as the mucopus accumulates.

In patients with edema of the extremities, ascites, and pleural effusion, Dr. Russell Haden has made the observation that this state is due to a changed relationship between the serum albumin and the serum proteins. A serious pitfall may follow any operative procedure on this type of patient.

In such cases the patient's blood should be replenished with normal serum and protein by means of blood transfusion. Blood transfusion should be repeated and repeated until the swelling, the ascites, and the state of the blood return to the normal.

Finally, the worst pitfall of all—death itself—may be overcome. In a case of my own—a patient with a large malignant adenoma causing labored respiration—a slow, oncoming asphyxia from obstruction was threatened.

This patient entered the hospital in the night. She was unable to lie down. When brought to the operating room, she was obliged to sit on the ward cart and was struggling for breath. The goiter was very large and the condition of the patient was such that general anesthesia was impossible. While I was wondering how we could meet this emergency, the patient fell back on the ward table in the operating room, the heart and respiration stopped. She was dead.

At the time, we had immediately available an emergency kit of adrenalin and saline. With no preparation of my hands or of the field, I exposed the goiter with a sweep of the knife and took it out while the patient was dead. I

had the advantage of only passive bleeding. As soon as the goiter was removed, we injected adrenalin solution into the heart and gave artificial respiration. In a minute or two, gasping respiration began, the heart leaped into activity, and within a few minutes regular respirations were restored, the vessels began to bleed, and the patient soon became conscious.

Despite the lack of preparation and despite the crisis, the patient recovered, and lived for 2½ years, when she died from a recurrence of the cancer.

One of the most common pitfalls is that of depending on the basal metabolic rate for setting the time and determining the extent of operation. To depend upon a laboratory procedure is like matching pennies for the fate of the patient.

Let us compare the information offered by the basal metabolic rate with the five factors of danger in goiter surgery. It is true that the recurring excitement and anxiety of an inexperienced technician would just about cancel the quieting effect of rest, Lugol's solution, and sedatives. A negative atmosphere of calm and quiet is essential for making a metabolism test in the patient with hyperthyroidism.

The first factor of danger in our complete reliance upon the basal metabolism test concerns the age of the patient. Now the age of the patient is more accurately obtained by asking and by observing the patient, than by determining the metabolic rate in order to ascertain the age.

The second factor of danger is the loss of heart reserve. More accurate information as to the heart function can be obtained by examining the heart than by determining the basal metabolic rate.

The third factor of danger is a change in the serum albumen serum protein relation in the blood. This danger cannot be estimated by a basal metabolic test.

The fourth factor of danger is the extreme loss of weight. Obviously, this is best determined by weighing the patient and by judging his appearance.

A fifth factor of danger is the lack of morale of the patient. It would seem as logical to weigh a man to find out how honest he is as to make a basal metabolism test to find out how brave he is. In other words, the surgeon should function as a physician rather than as a laboratory technician.

And this leads us to the most important pitfall of all—that presented by the differential diagnosis. First, there is the danger of making a hasty diagnosis of hyperthyroidism if the patient has an adenoma, tachycardia, nervousness, tremors, emotionalism, a metabolic rate of perhaps +15 per cent with little change in weight, great in-

stability in the pulse rate and little endurance, with a normal appetite and with excessively active sympathetic reflexes. In such a case thyroidectomy would remove the adenoma but would give only temporary relief from the symptoms which would soon reappear. In such a case the disease is neurocirculatory asthenia which cannot be cured by thyroidectomy, but for which denervation of the adrenal glands would give a specific cure.

Second, there is the danger of making a diagnosis of hyperthyroidism in the case in which the patient has a large adenoma with essential hypertension. The basal rate may run as high as +45 per cent but associated with this high metabolism rate there is less nervousness, less tremor, less emotionalism and less tachycardia than is present in a patient with hyperthyroidism with as high a basal metabolic rate. In such a case the high basal metabolic rate is due to the increased vascular bed of the adenoma and to the increased metabolism which is sometimes seen in uncomplicated cases of essential hypertension. In such

a case excision of the adenoma will fail to lower the basal metabolic rate and will fail to cure the essential hypertension. On the other hand bilateral lateral celiac ganglionectomy and denervation of the adrenal glands will lower the basal metabolic rate and abate or cure the hypertension.

Other errors in diagnosis are made in cases of goiter in which emotional instability and a moderate increase of the basal metabolic rate are presented in a patient who is passing through the menopause.

In all such cases of incorrect diagnosis the surgeon takes the goiter but the patient keeps the disease.

SUMMARY

We have endeavored to present some of the pitfalls which may be encountered in the surgical treatment of diseases of the thyroid gland. There are three prime requisites for the avoidance of all these pitfalls which are (1) to make a correct diagnosis, (2) to treat each patient strictly as an individual, and (3) to treat the emergency before it occurs.

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SEPTEMBER, 1938

PRE-OPERATIVE MEDICATION

DURING the last decade, pre-operative medication has been a frequent subject for discussion, and a wide variety of drugs has been suggested in various combinations and dosages, but so far, we have no single drug that we can call "ideal" Adequate preparation includes preparing the patient mentally as well as physically, and should begin with the admittance of the patient to the hospital. If he appears unduly nervous at the time of his arrival, a sedative is administered before any examinations are made. He should be advised that everything will be done to make him as comfortable as possible while in the hospital. Since it is essential that he have a good night's rest prior to operation, a sedative is given at bedtime, in sufficient dosage to produce sleep.

The object of preliminary medication is to allay any fear or apprehension on the part of the patient concerning the operation or anesthetic, and to bring the patient to the operat-

ing room in as normal a condition as possible. for the right mental attitude is often most helpful in attaining the best results. Hyper-sensitive, nervous patients may actually experience shock from fright alone, without having had any actual pain or discomfort. Preliminary medication as used today is not only beneficial to the patient and surgeon, but especially so to the anesthetist, for in addition to taking a smoother anesthetic, the actual amount of anesthesia used is less.

Morphine and its derivatives, hyoscine, the barbiturates, avertin, chlorbutanol, and paraldehyde are among the many drugs that have been suggested for pre-operative use. Quick acting sedatives of relatively short duration, are preferable to the longer acting hypnotics, since a prolonged narcosis with attendant depression of respirations is very undesirable, when a general anesthetic is used.

Pentobarbital sodium combined with morphine and atropine accomplishes more, and has less disadvantages than any of the other drugs commonly used and allows a wider choice of anesthetic agents. The dosage is varied according to the anesthetic used. When local anesthesia is used, larger doses of pentobarbital sodium are given as deeper sedation is desired. The barbiturates are definitely indicated in the field of local anesthesia, since they tend to neutralize any toxic effect that may arise from the procaine and at the same time they increase the tolerance of the patient for epinephrine, which is often combined with the local anesthetic. The only contra-indication to the use of the barbiturates before operation is when cyclopropane is to be used, since both drugs have a tendency to lessen the amplitude of the respirations.

When the primary lesion is removed in any of the last three groups, it should be termed a "palliative resection." In these patients there is little or no prospect of a cure, but they may receive sufficient benefit to justify resection of the primary lesion. To benefit this group of patients, resection will often be difficult and extensive.

During the 30 year period in the development of the operative management of malignant lesions of the large bowel, the "operability" or resection rate has unquestionably been rising. It was necessary early in this period to limit resection to the more favorable cases in order to evaluate results, to avoid complications, and to develop new operative plans of management. The operability rate has risen from approximately 30 per cent to 75 per cent. This rise is probably not due to an appreciable increase in the number of favorable cases submitted to resection, but has rather been due to the fact that the limits of operability have been extended to include many more advanced cases. The operability rate has also been influenced by other factors: an increased experience in dealing with the advanced cases, graded or stage operations, a lowered operative mortality, and a desire to extend the benefits of resection to as many cases as possible. Because of this later experience it is now possible to evaluate the benefits of resection for the extensive cases as well as for the favorable ones.

In order to justify its performance, resection of an extensive bowel malignancy, when the chance for cure is small, should offer real advantages. Palliative resection should not be performed in the face of a high operative

risk, it should bring comfort and reasonable activity and an expectancy of at least one year of life. The real problem, then, is to select the patients that can reasonably be expected to receive these benefits. No definite rules can be stated. It is obvious that the individual surgeon should base this decision upon his experience with more favorable cases. If in his hands the operative mortality is high, there will not be sufficient justification for extending the limits of operability, since a higher mortality can be expected in this group of advanced cases. The individual surgeon should carefully consider the findings in each case and decide whether resection is justifiable when the malignancy has extended beyond its primary site.

In later studies of the operative mortality, postoperative complications and late results, the palliative resections should be separated from the group of resections in which the malignancy has not extended beyond the bowel or regional nodes. Separation of the cases into these two groups will permit careful evaluation of resection in the advanced cases.

Based on our present experience with the less favorable cases of carcinoma of the large bowel, resection would seem justified in any patient who was a reasonable operative risk, who had an expectancy of life of over twelve months, and in whom it appeared technically feasible. Due to postoperative complications and a higher operative mortality, the pursuance of this policy will at times be disappointing. However, there will be many quite satisfactory results in the apparently advanced case now too often refused the help that resection may offer.

R. B. CATTELL

Avertin, which was originally used as an anesthetic with variable success, is now used satisfactorily in selected cases for preliminary medication.

For years morphine and hyoscine have been widely used before operation. In the majority of cases they are very satisfactory, as they allay all fear and apprehension, but they may produce too profound a narcosis, which is decidedly undesirable. Hyoscine may cause some patients to become delirious and unruly, while in others the respirations may be extremely depressed or the heart rate markedly accelerated. Furthermore, the narcosis is of ten prolonged following the operation and at times may even be alarming.

In order to ascertain whether pre operative medication influenced the postoperative course, a study was made of the records of over 9 000 major operations which were performed at St. Luke's Hospital, St. Louis. The cases studied were placed in three groups according to the drugs used before operation: morphine-atropine, morphine-hyoscine, and morphine-atropine and one of the barbiturates. Some rather interesting facts were revealed. Similar complications occurred after each type of medication, but there were only two that stood out conspicuously enough to warrant special consideration: namely, catheterization and the subsequent development of cystitis and pyelitis as manifested by pus in the urine.

Comparative studies were made of each type of operation and of each pre-operative drug, and in every incident the percentage of postoperative complications was higher when hyoscine had been used. The analysis showed that 18.7 per cent of the patients who had received morphine and atropine developed some form of postoperative complication, while in the morphine-hyoscine group, complications occurred in 43.8 per cent and in the morphine-atropine-barbital group in only 16.9 per cent.

From this study it appears that the preoperative drug does influence the postoperative course and also that one is justified in stating that hyoscine combined with morphine is contra-indicated for pre-operative preparation. The most satisfactory preparation is the administration of 3 grains of pentobarbital sodium dissolved in 10 cubic centimeters of normal saline and given as a retention enema one and one half hours prior to the operation, and in forty five minutes this is followed by a hypodermic injection of $\frac{1}{2}$ grain of morphine combined with $1/150$ grain of atropine sulphate.

E. VERNON MASTIN

PALLIATIVE RESECTION FOR EXTENSIVE LARGE BOWEL MALIGNANCY

THE generally accepted opinion regarding malignant growths which are still localized to the bowel is that they should be treated by radical surgery. In cases in which the growth is more extensive and perhaps also accompanied by metastases local or distant, there is no well established opinion. In some of these cases radical surgery should be attempted although the resection may not remove all of the malignancy. Accumulated experience in handling the more advanced cases seems to justify radical resection even though there seems little or no prospect of cure.

In 30 to 40 per cent of all the cases observed the lesion is localized to its point of origin in the wall of the bowel. It is in this group that a radical operation offers the best chance for cure. There is an additional 30 to 40 per cent of cases that are less favorable. This is because (1) there is extension to the regional lymph nodes (2) local invasion and adherence to contiguous structures (3) spread to distant nodes, and (4) liver metastases.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

IN THE preface of *Chemistry of the Brain*¹ the author states "This book attempts to bring together data which are widely scattered in the literature in as orderly a position as possible" The subject matter is divided into chapters, the first of which deals with a very interesting history of the early researches on analysis of the brain Then follow chapters upon sterols, phosphatides, fatty acid metabolism, cerebroside, carbohydrates, nitrogenous metabolism, electrolytes and gases, physical chemistry, enzymes of the brain, comparative and developmental neurochemistry, metabolism of the central nervous system as measured by gas interchange, pathological gaseous metabolism, diets, vitamins and degeneration of the nervous system, oxidations in the brain, and last a quasi philosophic consideration of the brain and thought

Although the title of this book is *Chemistry of the Brain*, as can be seen from the contents, it also deals with the chemistry of the cord and nerves, in short neurochemistry It is stated in the preface that one of the "techniques" for studying the chemistry of the brain is "the analysis of the chemical consequences of the activity in various so called 'regulatory centers' of the brain, such as the sugar and respiratory centers" This "technique," therefore, must combine chemistry with physiology and pharmacology. In addition there is included in the text chemical responses to many procedures—psychologic stimuli, drugs, oxygen deprivation, carbon dioxide administration, metals, and food stuffs The inclusion of such matter often dealing more with physiology of endocrine and other organ function changes seemed to the reviewer, since such data are already well documented, to add little to the value of the book and to detract from its value a continuity of reasoning

Throughout the book are noted the results of studies upon the subject matter of each chapter in nervous diseases They are presented with little consideration as to the credibility of the results as judged by the training in chemistry of the author, methods used, and the logic of deductions Since in many instances the authors were clinicians, it was rather the rule that some found a certain change while others either were unable to find it or found a different change The result is that there are named a series of changes in relation to various diseases which leave the reader in a state of confusion Although these notations occupy a considerable portion of the book, the index is deficient in that were one interested in finding the chemical changes

occurring in some one disease as schizophrenia he would be unable to find it unless he searched under each chapter

It seemed that many controversial results were included and other authenticated ones omitted For example, the regulation of metabolism by brain centers is discussed with a short paragraph, and there is no mention of all of the important work upon metabolic processes regulated by areas in the hypothalamus of recent years Although disturbance of creatin-creatinin metabolism is described as occurring in polyneuritis, dementia præcox, other diseases, and scurvy, no mention is made of its change in the one condition in which it is constantly found, progressive muscular dystrophy On the other hand, one finds such a statement as "Voluntary overbreathing may bring about a comparable condition to that noted in hysteria and encephalitis" What it may bring about is a state of alkalosis, whether in hysteria or encephalitis or in normal man but certainly nothing else. When an attempt is made to draw conclusions from comparing the psychologic effect upon catatonics of breathing 20 to 30 per cent carbon dioxide gas mixtures with those of amytal, one gets far afield from chemistry

In the preface the author states "Clinicians will no doubt object that this book is too chemical and the chemists that it is too clinical" The reviewer thinks that it is not chemical enough The clinical applications should either be omitted or critically analyzed and properly indexed

Referring to the original purpose of the book, namely, to bring together data which are widely scattered in the literature, it is with great pleasure that one sees such an attempt The clumsy attempts of clinicians to dabble in chemistry, their blind groping contrasted to excellence of chemical technique, indicate the necessity for teaching chemistry to clinicians and stimulating chemists to undertake research in diseases of the nervous system These this book does and very well The selections of subject matter have been made with fine discrimination with regard to relative importance, accessibility of literature, and need for work This may be illustrated by the emphasis upon the rôle of the lipids The other chapters are equally well presented and adequate source references at the beginning of each chapter are very valuable Occasionally one may find some statement to which exception might be made, for example, it would seem from micro-incineration methods that the conclusion of Spatz, which is quoted, that the substantia nigra was rich in iron, is incorrect

¹CHEMISTRY OF THE BRAIN By Irvine H. Page, A.B. (Chem.), M.D. Springfield, Ill., and Baltimore, Md. Charles C. Thomas, 1937



Philadelphia, 4th and 1851

Dear Mr. Holden —

I have been able to thank
you for the honor you have done me
in sending me a copy of your beautiful
& it has been your that I forwarded to
your address nearly two weeks ago a copy
of other matter of the kind of the periodical
if my bookish these afford you half

as much gratification as the periodical of
your address affords me. I shall be very
compensated for the trouble when I per-
ceive a writing to John Hunter of great
distinction as the highest world grade in human
life knowledge. To show you the reason
in which I always held him. I may mention
that, more than forty years ago, I named
a son for him the however, died in his in-
fancy

I am always glad to meet

with an Englishman & if you could
ever come to Philadelphia no one else
be more glad to welcome you than I

With kind regards I remain
Mr. Holden, very truly, your friend,

Samuel D. Gross }
L. D. G. 1851

the simple bit of advice to perform laparotomy when the diagnosis of ectopic pregnancy is made. However, it seems that too much emphasis is placed on the conservative management of this condition. This is about the only condition in which a ruptured viscus is not treated by immediate surgery and it has always been puzzling that since hemorrhage always accompanies this rupture there are those who still advise "treating the shock before operating." This shock means exsanguination and the best means of treating that is first to stop the blood loss and then to restore the loss by transfusion. The authors unquestionably outline the treatment of this condition for the general practitioner and not for the experienced operator. More emphasis on the restoration of lost blood might well be included in the consideration of this subject.

Under the heading of "Myoma and Adenomyoma of the Uterus" methods of radical treatment are delineated. These comprise the various operative procedures and radiation. The authors' technique for hysterectomy is set forth and is admittedly different from that of most other operators, however, the reason for each step of the operation is explained in detail. Radiation methods are discussed and the type of radiation and the plan of selection of cases for each type of treatment are outlined.

One hundred and thirty pages are devoted to cancer of the uterus, representing an exhaustive survey of the subject. Every aspect of this all important problem of gynecology is covered. The authors' choice of treatment for carcinoma of the cervix uteri is radiation alone and a chronological résumé of their wide experience in dealing with this condition is presented. Statistics are quoted from the works of the authors as well as of several other workers in this field, which emphasize two things (1) that the mortality from carcinoma of the cervix is high (75 per cent) and (2), that the reason for this is that the majority of cases are well advanced when first seen. After a most masterful presentation of the subject, the authors repeat the oft-expressed hope that the answer to this great problem will be met and they admonish the medical profession to be ever alert in this connection to their civic responsibilities.

The subject of carcinoma of the corpus includes points of diagnosis, pathologic grading, and clinical classification. In commenting on the principles of treatment, the authors point out that carcinoma of the corpus may be diagnosed earlier than carcinoma of the cervix, its location in the endometrium causes bleeding, so that the patient consults the physician early, and a diagnosis is made and treatment instituted before the condition is too far advanced. Thus carcinoma of the corpus is more favorable for surgery, but is less favorable for radiation therapy since carcinoma of the cervix is more easily reached. Pre-operative radiation is advised for carcinoma of the corpus, it devitalizes the carcinoma and diminishes the chance of spread at the time of operation.

The various methods of dealing with inflammations of the cervix are discussed and described. Illustrations are plentiful and graphic. The technique of curettage, its indications and its dangers are stressed.

The next 300 pages of this book are devoted to corrective and plastic procedures. Retrodisplacements, prolapse, lacerations of the pelvic floor, and genital fistulas are all very thoroughly considered, and the various and numerous operations for each condition are described. The illustrations are well chosen to exemplify a particular point. Malformations and operative procedures for their correction are adequately discussed.

The remainder of the book considers the subjects of anesthesia, after-care of the patient, and medico-legal problems.

This book represents a tremendous amount of work and experience. Like all works of its kind, it must necessarily reflect the personality of its author and his own ideas which may conflict with the ideas of other experienced workers in the same field, but such conflicts of ideas and procedures are for the most part minor, which in the end have little effect on the more important phases of the subject. Fundamentally in the field of gynecology, there is rather uniform agreement among the leaders in this specialty as to the most rational methods of treatment and much of the credit for this uniformity of ideas and procedures must go to the senior author of this book and his contemporaries who have contributed so much to the advance of gynecology. The book deserves a place in the library of every gynecologist and will guide the general practitioner in the right direction.

C C DOHERTY

THE book *A Practice of Orthopaedic Surgery*¹ represents the most commonly accepted conceptions of orthopaedic surgery in the English speaking countries. It is a clear and concise exposition of orthopaedic surgery in the form of a syllabus. From the book, it is evident that the author is of the school of that great teacher of orthopaedic surgery, Sir Robert Jones.

For the most part, controversial ideas, such as individual technique, are wisely circumvented. The subject matter is presented with primary emphasis on principles. At the same time, the book is practical and shows selection of an experienced orthopaedist. No attempt has been made to make it complete and it is in no sense a reference book nor does it represent an advancement in progress in orthopaedic surgery.

To the orthopaedic surgeon it offers little that is new, for him the exposition may be too incomplete and not very stimulating. It is an excellent book for students. The material is chosen wisely on the basis of practical knowledge from the point of view of teaching, and definitely represents the teaching of the Liverpool University.

EMIL HAUSER

¹A PRACTICE OF ORTHOPAEDIC SURGERY. By T. P. McMurray, M.B., M.Ch., F.R.C.S. (Edin.) Baltimore: William Wood & Co., 1937.

It should be expected that this book will stimulate much needed work in chemistry of the nervous system direct clinicians properly to plan experiments prevent repetition of needless work and bring about a better understanding of the functions of the nervous system

LEWIS J. POLLOCK

THE title of the book is somewhat misleading for this *Horse and Buggy Doctor* is a medical and surgical specialist of high order in disguise. No medical practitioner can fail to enjoy his thrilling story of the education of a doctor—boyhood school days that rival Tom Sawyer's a medical course at Northwestern under Jaggard and Fenger a practical course in fighting diphtheria and mud pneumonia and snow drifts typhoid and vicious dogs for four years on the Kansas prairies two years of intensive study in Berlin under Hans Virchow the pathologist Waldeyer, the anatomist, von Bergmann the surgeon two years during which he 'missed working in the university six Sundays just gadding around and one week day sick' finally seven years as professor of histology and pathology in the University Medical College of Kansas City at fifty dollars a month.

The students were of all ages and previous conditions of servitude—butchers barbers bricklayers reformed schoolteachers and clergymen. Living with them in the laboratory much of the day I learned to know them well. The fine regard these boys have favored me with down through the years is still a constant source of pleasure and a magnificent reward for doing my best for them. Though there is no evidence that any of them remembered any of the pathology I tried to teach them they seem to have remembered all the jokes. My stories at least must have been good.

Equally fascinating is the story of the trials and successes of kitchen surgery and the hospital that eventually developed at Halstead, Kansas in spite of various and sundry diseases (that laid low the doctor himself) and the devil's cohorts my fellow citizens.

To dwell too much on the story however would be to overlook the wise philosophy and deep understanding which runs through every chapter of this book. To look beyond the nausea and vomiting the sudden dysphagia the loss of weight the sleeplessness and discern the young woman whose sweetheart had jilted her the unhappy wife who suffered from the fear of another pregnancy or from blondophobia the business man worried to distraction by financial reverses and thoughts of a family unprovided for the father constantly confronted with the picture of a loved one gone beyond recall—these are lessons the author learned in the strenuous years that were literally filled to overflowing with work hard ship fun grief and brilliant success.

No young surgeon who reads this book will fail to find help and guidance in some of the many problems

that constantly confront him. No older man but will live again with the author both happy and unforgettable experiences of the days gone by.

SUMNER J. KOCH

IN THE preface of the comprehensive work entitled *Operative Gynecology*¹ the senior author states that the book has been largely rewritten and rearranged. There are 200 new illustrations in this fifth edition of the book which brings the total up to 1264 illustrations.

The ovaries are the first subject to receive consideration in this work. The procedure followed in arriving at a diagnosis is outlined and the factors considered in an individual case to determine whether or not to operate on that patient are enumerated. The danger of postoperative peritonitis in cases of endometriosis is emphasized, the authors preferring to drain in all cases of endometriosis. This is rather a new idea and one heretofore not considered by other authors. It would seem that the Crossens view with alarm a condition that is not generally put in the high brackets of mortality and morbidity by others experienced in the treatment of this condition. Ovarian pathology is outlined and the choice of treatment in each type of case is suggested. Case reports from the authors experience are frequently cited to emphasize the indication for a given procedure.

Pelvic inflammations are next considered. In acute salpingitis conservatism is advised surgery being resorted to only in the late stages and then only if a persistence of symptoms warrants it. General sepsis appendicitis tubal pregnancy pelvic endometriosis and pelvic tumors with a twisted pedicle are conditions mentioned in the differential diagnosis of acute salpingitis. In dealing with acute pelvic cellulitis the various sites of abscess formation are discussed and the technique of draining is described. A warning of the danger of irrigating these cavities is voiced; the authors prefer to rely on gauze drainage. Under the treatment of acute thrombophlebitis a method for the ligation and excision of the ovarian veins with removal of the adnexa and even the uterus is described. The operative management of chronic salpingo-oophoritis is outlined the choice of procedure depending on the amount of involvement.

Admonition to differentiate clearly between the presence of gonococci and the streptococci as etiological factors in chronic pelvic disease is well emphasized the authors voicing the generally accepted opinion that it is never safe to operate in the presence of a streptococcus infection.

Other diseases of the ovaries and tubes are treated in chapter 3. In pelvic tuberculosis removal of the affected parts is advised. In considering ectopic pregnancy the authors deal with the various phases of this subject and do not pass it off with

¹The Horse and Buggy Doctor. By Arthur E. Hart. 420 New York and London. Harper & B. 1935.

OPERATIVE GYNECOLOGY. By H. C. H. Brown, M.D., and Robt. James Crozier, M.D. 5th ed. St. Louis. The C. V. Mosby Co. 1935.

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PRELIMINARY PROGRAM FOR 1938 CLINICAL CONGRESS

THE surgeons of greater New York, under the leadership of strong and representative committees, plan to present a program of operative clinics and demonstrations for the twenty-eighth annual Clinical Congress of the American College of Surgeons, October 17 to 21, that will provide a complete showing of their clinical activities in all departments of surgery of that great medical center. The committees have the hearty co-operation of the clinicians at the five medical schools and more than seventy hospitals that will participate in the clinical program.

A preliminary schedule of operative clinics and demonstrations at the hospitals and medical schools is presented in the following pages. This will be revised and amplified during the weeks preceding the Congress. Clinics are to be held on the afternoon of Monday, October 17, and the mornings and afternoons of each of the following four days. Wednesday, October 19, has been designated as Brooklyn-Long Island day and the clinical program on that day will be presented in Brooklyn hospitals.

In addition to an ample and well-arranged schedule of operative clinics, at which the technique of a wide variety of surgical procedures will be demonstrated in the operating rooms, the committees have arranged a series of non-operative clinics in many of the large hospitals and the medical schools for the presentation of important work being done in many special fields, such as fractures, cancer, traumatic surgery, neurosurgery, thoracic surgery, plastic surgery, experimental surgery, etc. It will be noted that the

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programs are so correlated that the visiting surgeon may be assured of the opportunity to devote his time continuously, if he so desires, to clinics dealing particularly with the special subject in which he is most interested. As for example, clinics in thoracic surgery, neurosurgery, fractures, etc., will be available each forenoon and afternoon during the Congress.

The actual program of the Congress will be published from day to day in the *Daily Clinical Bulletin*. A complete detailed clinical program will be posted in the form of bulletins at headquarters each afternoon for the succeeding day.

PRELIMINARY thumbing through *Fractures and Dislocations*¹ a small indexed volume of 246 pages suggests that no attempt was made to make it encyclopedic but rather to present the more common varieties of fracture and methods of treatment that have been successful in the author's hands. Appended to each chapter is a reference list of standard texts on the subject matter of the chapter and journal citations in which the reader can get additional and more detailed information.

Before taking up the treatment of specific bone injuries the author devotes about 43 pages to the important fundamental considerations in this field namely bone repair examination of suspected fractures complications, and the medicolegal aspects of this phase of surgery. The general principles of immediate treatment emergency splinting immobilization, traction and after care are also briefly discussed.

The remainder of the text is devoted to the treatment of various fractures systematically set forth. The principles and methods advocated by the author are generally in accord with contemporary thought and little substance of controversial nature is found in the book.

The illustrations of line drawings and photographs clearly depict what is intended and only occasionally is an x ray print found to be inadequate.

JAMES K. SEACK

FRACTURES AND DISLOCATIONS FOR PRACTITIONERS. By Edwin O. Gekeler M.D. Baltimore: Will. B. Saunders & Co. 1937.

REPRINTED from the *Oxford Monographs on Diagnosis and Treatment* which are edited by Dr. Henry A. Christian the first edition of the monograph *The Diagnosis and Treatment of Diseases of the Blood*² by Ordway and Gorham appeared in 1930 and was reviewed in this journal in 1930. The present edition is identical with the first except the revision of the section on treatment of pernicious anemia and the addition of chapters on standards in description of blood hypochromic (chlorotic) anemias and monocytic leucemia. Two pages have also been added on sheep cell agglutination in the diagnosis of infectious mononucleosis. The book is then not up to date on all subjects. The many advances in the diagnosis and treatment of blood diseases which have been made in the last 7 years certainly warrant a more thorough revision of such a volume.

Aside from this criticism the book has considerable merit. The colored plates of blood smears are extremely realistic and the figures help to illustrate certain features of the blood diseases. The clinical descriptions are frequently accompanied by representative case histories. This monograph should continue to be helpful to the practicing physician in the diagnosis and treatment of hematologic conditions.

HOWARD L. ALT

¹THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE BLOOD. By Ordway and Gorham. M.D. Baltimore: W. B. Saunders & Co. 1937. Pp. 246. \$1.50. ²THE BLOOD. By Ordway and Gorham. M.D. Baltimore: W. B. Saunders & Co. 1937. Pp. 246. \$1.50.

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

A TEXTBOOK OF GYNECOLOGY. By Arthur Hale Curtis M.D. 3d ed. Philadelphia and London: W. B. Saunders Co. 1938.

THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY: A COMPLETE DICTIONARY OF THE TERMS USED IN MEDICINE, SURGERY, DENTISTRY, PHARMACY, CHEMISTRY, NURSING, VETERINARY SCIENCE, BIOLOGY, MEDICAL BIOGRAPHY, ETC., WITH THE PRONUNCIATION, DERIVATION, AND DEFINITION. By W. A. Newman Dorland A.M. M.D. F.A.C.S. 18th rev. and enl. ed. With the collaboration of E. C. L. Miller M.D. Philadelphia and London: W. B. Saunders Co. 1938.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by Richard M. Hewitt B.A. M.A. M.D. Lloyd G. Potter A.B. Nesling M.D. and Harry L. Day Ph.B. M.D. Vol. 29—1937. Philadelphia and London: W. B. Saunders Co. 1938.

A TEXTBOOK OF HISTOLOGY: FUNCTIONAL SIGNIFICANCE OF CELLS AND INTERCELLULAR SUBSTANCES. By E. V. Cowdry 2d rev. ed. Philadelphia: Lea & Febiger 1938.

THE SURGICAL TREATMENT OF HYPERTENSION. By George Crile. Edited by Amy Rowland. Philadelphia and London: W. B. Saunders Co. 1938.

SULFANILAMIDE THERAPY OF BACTERIAL INFECTIONS WITH SPECIAL REFERENCE TO DISEASES CAUSED BY HEMOLYTIC STREPTOCOCCI, PNEUMOCOCCI, MENINGOCOCCI AND GONOCOCCI. By Ralph R. Mellon M.D. Dr. P.H.D. Sc.(Hon.) Paul Gross M.D. and Frank B. Cooper M.S. Springfield Ill. and Baltimore Md. Charles C. Thomas 1938.

THE VITAMINS AND THEIR CLINICAL APPLICATION. By Prof. Dr. W. Stepp Doz. Dr. Kuehnau and Dr. H. Schroe der. Translated by Herman A. H. Bouman M.D. Milwaukee Wis. The Vitamin Products Co. 1938.

OUTLINE OF ROENTGEN DIAGNOSIS: AN ORIENTATION IN THE BASIC PRINCIPLES OF DIAGNOSIS BY THE ROENTGEN METHOD. By Leo G. Rigler P.S. M.B. M.D. Atlas edition and exclusive text edition. Philadelphia: London: Montreal and New York: J. B. Lippincott Co. 1938.

THE ROCKEFELLER FOUNDATION: Annual Report 1937. New York 1938.

THE STORY OF THE LYING IN HOSPITAL OF THE CITY OF NEW YORK. By James A. Harrar M.D. New York: The Society of The Lying In Hospital 1938.

CANCER WITH SPECIAL REFERENCE TO CANCER OF THE BREAST. By R. J. Behan M.D. Dr. Med. (Berl.) F.A.C.S. St. Louis: The C. V. Mosby Co. 1938.

PRACTICAL OTOTOLOGY. By Morris Levine M.D. F.I.C.S. 2d rev. ed. Philadelphia: Lea & Febiger 1938.

DIE KNOCHENGESCHWULSTE. By Dr. med. habil. Hans Heller. Berlin: Julius Springer 1938.

via taxicab has been arranged, effective between the hours of 8 and 10 a. m. This will obviate the necessity of depending upon the usual transportation and assures prompt arrival of the fellows at their desired destinations

At each institution a morning program of both operative and dry clinics will be presented from 9 a. m. to 12.30 p. m., followed by a luncheon to the visitors. The afternoon has been set aside for the presentation of symposia covering all of the specialties and arrangements have been made for adequate transportation from one hospital to another at midday, so as to facilitate attendance at any symposium selected. Each symposium will be presided over by a moderator, whose duty it will be to keep the papers within the time limit, so that the programs will conclude at 4 p. m. The evening session will be held in the ballroom of the Waldorf-Astoria at 8 o'clock.

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On Monday afternoon, and on Tuesday, Wednesday, and Thursday, both mornings and afternoons, an interesting program of papers, round table conferences, and practical demonstrations, all dealing with various problems related to efficiency in the hospital, will be presented. For Wednesday afternoon, in certain local hospitals, a limited number of well planned demonstrations in administrative and technical procedures are scheduled.

A conference on maternal care on Tuesday afternoon should be of especial interest. This will be followed by a demonstration planned to evaluate, through hearings and discussions of individual fatalities occurring in the obstetrical services of various New York hospitals, the causes of maternal deaths.

The final conference on Thursday afternoon will be conducted as an administrative panel round table discussion in which an effort will be made to cover as many aspects of hospital administration as possible, with particular emphasis on maintenance of high professional standards, current economic problems and trends, and other timely subjects.

ADVANCE REGISTRATION

The hospitals and medical schools of Greater New York afford accommodation for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be limited to a number that can be comfortably accommodated at the clinics. The limit of attendance will be based upon the result of a survey of the operating rooms and laboratories of the hospitals and medical schools, to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance. A registration fee will be required of surgeons attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the Congress. To each surgeon registering in advance

and published in printed form for distribution the following morning

The annual meeting of the governors and fellows of the College will be held in the ballroom of the Waldorf Astoria on Thursday afternoon at 1 to 6 o'clock. Reports on activities of the College will be presented by the officers and chairmen of standing committees, to be followed by the election of officers.

The attention of fellows is called to the meetings of three committees to be held in the Empire Room on Tuesday forenoon, as follows: State and Provincial Judiciary Committees at 9:30, State and Provincial Credential Committees at 10, State and Provincial Executive Committees at 11.

The showing of surgical motion picture films which so faithfully depict clinical features of major interest to most surgeons will be continued at this year's Congress. It is planned to present an enlarged program of both sound and silent pictures at daily exhibitions at headquarters.

SCIENTIFIC SESSIONS—AFTERNOONS AND EVENINGS

In the arrangement of the program for the Clinical Congress certain new features which were introduced at the 1937 meeting met with such success as to justify their inclusion this year and certain entirely new features have been added to the program.

On Monday afternoon the initiates will be assembled so that officials of the College may explain to them in some detail the College's program. At this same session the Fellowship Roll will be signed by the initiates and an informal reception will follow the more formal program. In the evening, the Presidential Meeting and Convocation will be combined, and at this time the new officers will be inaugurated and the initiates will be received into fellowship. A number of distinguished surgeons from foreign countries will be introduced at this session. Dr. Walter W. Chipman of Montreal will present the annual oration on surgery in which he will pay tribute to the work of the late Dr. Allen B. Karavel.

Scientific meetings will be held at headquarters on Tuesday, Wednesday and Thursday evenings in which medical men will co-operate with the surgeons in presenting various phases of the interesting subjects which have been selected for presentation. Each of these programs will present subjects of a diversified nature. The Wednesday evening program has been arranged with the co-operation of the Brooklyn Chapter of the College.

On Wednesday afternoon a symposium on the subject of "Surgical Procedures on the Handicapped Patient" will be presented, in which anesthesiologists and internists will co-operate with surgeons.

Programs for special evening sessions for the otolaryngologists and ophthalmologists have been prepared for Tuesday and Thursday evenings.

As in former years afternoon symposia have been arranged on the subjects of cancer, fractures and industrial medicine and traumatic surgery. To these have been added symposia on urologic infections and on obstetrics and gynecology.

The program committee has aimed to include a selection of material at these various scientific meetings which will make it possible for all of the general surgeons and surgical specialists attending the Congress to hear the work in their own specialties presented from many different angles.

Is an entirely new feature there has been added a series of twelve midday round table conferences in order to give an opportunity for formal and informal discussion of subjects in more restricted fields than would be susceptible of treatment in the general meetings. Registration for these round table conferences will necessarily be restricted to the capacity of the rooms in which they will be held. The College has been able to secure the co-operation of authorities in each one of the selected subjects to lead, direct and participate in the discussions. The general plan to be followed is that the leader will present the subject to be discussed within a ten minute period and selected men will discuss various phases of these topics very briefly after which general discussion from the floor will be encouraged.

The details of all these programs are presented in the following pages.

BROOKLYN LONG ISLAND DAY

The program for Brooklyn Long Island Day has been materially altered to better serve the interests of the visiting fellows, from the preliminary program published in July. A concentration has been effected whereby eleven institutions located in mid Brooklyn will afford the physical accommodations for the presentation of the scientific program. The institutions selected are of such size as to comfortably accommodate all the visiting fellows and their geographic location is such that the distance from headquarters is but a matter of minutes.

Through the courtesy of the Brooklyn and Long Island chapter free transportation from the Waldorf Astoria to the Brooklyn institutions

via taxicab has been arranged, effective between the hours of 8 and 10 a m. This will obviate the necessity of depending upon the usual transportation and assures prompt arrival of the fellows at their desired destinations.

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a formal receipt will be issued, which is to be exchanged for a general admission card upon his registration at headquarters during the Congress. This card is not transferable and must be presented in order to secure clinic tickets and admission to scientific sessions.

A resolution adopted by the Board of Regents provides that the registration fee for fellows and endorsed junior candidates shall be \$5.00, that no fee for the 1938 Congress shall be required of initiates (class of 1938) that the fee for non-fellows attending as invited guests of the College will be \$10.00.

Admittance to clinics and demonstrations at the hospitals will be controlled by means of clinic tickets. This plan provides an efficient means for the distribution of the visiting surgeons among the various clinics and assures against overcrowding. The number of tickets issued for any clinic will be limited to the capacity of the room in which the clinic is given.

HEADQUARTERS—TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Waldorf Astoria Hotel, on Park Avenue between 49th and 50th Streets where the grand ballroom and large adjacent foyers, the Astor Gallery, Jade and Basildon Rooms all on the third floor of the hotel, have been reserved for Congress headquarters—scientific sessions and conferences and for the scientific and technical exhibits.

The technical exhibition together with the registration and clinic ticket bureaus, will be

located in the East Foyer Astor Gallery, Jade and Basildon Rooms all on the third floor of the hotel. The bulletin boards, on which the daily clinical program will be posted each afternoon for the following day, will be placed in these rooms. Leading manufacturers of surgical instruments, x-ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus and supplies of all kinds, pharmaceuticals and publishers of medical books will be represented in this exhibition.

NEW YORK HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Waldorf Astoria, there are many first-class hotels within short walking distance of headquarters, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee.

	Mum Rate with Bk Single	Double
Ambassador Park Ave at 31st St	\$6.00	\$8.00
Barclay 111 East 48th St	6.00	10.00
Belmont Plaza Lexington Ave at 49th St	3.50	6.00
Baltimore Madison Ave at 44th St	6.00	8.00
Chatham Vanderbilt Ave at 43th St	4.00	7.00
Commodore 42nd St at Lexington Ave	3.50	5.00
Lexington Lexington Ave at 48th St	3.50	4.50
New Weston Madison Ave at 50th St	4.00	6.00
Park Lane 290 Park Ave	6.00	8.00
Ritz Carlton Madison Ave at 46th St	7.00	9.00
Roosevelt Madison Ave at 45th St	5.00	7.00
Shelton Lexington Ave at 45th St	3.00	4.50
Waldorf Astoria Park Ave at 50th St	7.00	10.00

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday 10.00—Ballroom Waldorf Astoria Hotel

FREDERIC A. BESLEY M.D. Waukegan President American College of Surgeons presiding

Address of the President—Twenty-one Years of Hospital Standardization Resulting Benefits to Medical Science

The 1938 Hospital Standardization Survey—Official Announcement of the List of Approved Hospitals
GEORGE CARLE M.D. Cleveland Chairman Board of Regents American College of Surgeons.

Report of Survey—Graduate Training for Surgery Announcement of List of Hospitals Acceptable for Graduate Training for General Surgery and the Surgical Specialties DALLAS B. FREEMAN M.D. Chicago
Organizing and Executing a Plan for Graduate Training for Surgery in a Hospital HAROLD EARNHEART M.D. Chicago

Panel Discussion—Content of Courses for Adequate Training in General Surgery and the Surgical Specialties from the following viewpoints
General Surgery ALLEN O. WHIFFLE M.D. New York

Obstetrics and Gynecology JOHN R. FRASER M.D. Montreal

Neurosurgery HOWARD C. NAFFZIGER M.D. San Francisco

Urology HERMAN L. KRETSCHMER M.D. Chicago

Orthopedics PHILIP D. WILSON M.D. New York

Discussion Led by ARTHUR M. WRIGHT M.D. New York and DERYL HART M.D. Durham N.C.

Monday 2.00—Sert Room Waldorf Astoria Hotel

ALLAN CRAIG M.D. Bangor Maine presiding
Co-operation Between Voluntary and Governmental or Tax Supported Hospitals S. S. GOLDWATER M.D., New York

Present Trends in Nursing as Affecting Nursing Education and Nursing Service in Hospitals EFFIE J. TAYLOR New Haven

A Grading Program for Schools of Nurses. REV. A. M. SCHWITALLA S.J. St. Louis

Personnel Management JOSEPH C. DOANE M.D., Philadelphia

The Organization and Management of Volunteer Service in the Hospital CHRISTOPHER G PARNALL, M D, Rochester, N Y.

The Role of Bibliotherapy in the Care of the Patient GORDON R KAMMAN, M D, St Paul

Discussion Led by OLIVER H BARTINE, Bridgeport, Conn

Tuesday, 9 30—Sert Room, Waldorf-Astoria Hotel

FRASER D MOONEY, M D, Buffalo, presiding

Panel Round Table Discussion—Physical and Other Conditions in the Hospital Related to the Care of the Patient and the Working Conditions of the Personnel Lighting in the Operating Room WILLIAM J ENGEL, M D, Cleveland

Color in the Hospital WILLIAM H WALSH, M D, Chicago

Air Conditioning in Hospitals VICTOR A FRID, Hartford, Conn

Noise in the Hospital, Its Effect on Patients, Its Control HARVEY AGNEW, M D, Toronto

Emergency Lighting in Hospitals CHARLES F NEERGAARD, New York

Provision for Isolation of Infected Patients in General Hospitals A J MCRAE, M D, Hempstead, N Y

Preparedness for Emergencies MIRIAM CURTIS, R N, Northampton, Mass

Infections, Sources and Control CLAUDE W MUNGER, M D, New York

Blood Bank Service (Illustrated by motion picture) KARL A MEYER M D, Chicago, and LEONARD H WEISSMAN, M D, Chicago

Tuesday, 2 00—Sert Room, Waldorf-Astoria Hotel

GEORGE W KOSMAK, M D, New York, presiding

Presentation of the Minimum Requirements of the American College of Surgeons for the Obstetrical Department in a General Hospital MALCOLM T MACEACHERN, M D, Chicago

Panel Discussion—The Care of the Mother and the Newborn in the General Hospital

Discussion from the viewpoints of

Organization of the Obstetrical Department so as to Provide Administrative and Clinical Efficiency and Control FRED L ADAIR, M D, Chicago

Provision and Indications for Segregation and Isolation of Obstetrical Patients and Newborn to Prevent Infection HERMAN W JOHNSON, M D, Houston

Organization of the Obstetrical Staff with Particular Reference to Qualifications and Grading of Privileges HARVEY B MATTHEWS, M D, Brooklyn

Indications for Consultations on the Obstetrical Service and Proper Procedure in Securing These PAUL TITUS, M D, Pittsburgh

Analysis of the Clinical Work of the Obstetrical Service with Special Emphasis on Morbidities and Mortalities JAMES R MILLER, M D, Hartford

Assuring the Mother and the Newborn Efficient Nursing Care JESSIE J TURNBULL, R N, Pittsburgh

Proper Training of Interns and Residents in Obstetrics through Arrangement of Services, Supervision of Work, and Instruction SAMUEL A COSGROVE, M D, Jersey City

Palm Print Method of Infant Identification with Demonstration GILBERT P POND, M D, Oak Park, Ill

Demonstration Evaluating of Maternal Fatalities Conducted by the Maternal Welfare Committee, New York County Medical Society

Wednesday, 10 00—Sert Room, Waldorf-Astoria Hotel
Joint Conference with Association of Record Librarians of North America

JAMES T NIX, M D, New Orleans, presiding

The Program of the Association of Record Librarians of North America as it Affects Hospitals JENNIE C JONES, R R L, Baltimore.

The Ills of Medical Records and Their Remedies Delay in Writing, Incompleteness, Unscientific Value, Insufficient Use GORDON R KAMMAN, M D, St Paul

The Medical Records Librarian Qualifications, Responsibilities, and Duties HELEN ROBINSON, R R L, Little Rock, Ark

How the Medical Records Librarian Can Assist the Physician in Securing Medical Records NORMA SWANSON, Red Wing, Minn

Panel Discussion—Uses of the Medical Record Monthly Analysis Report for Medical Audit LEONARD SHAW, Chicago

Making Group Studies of Diseases MARY M NEWTON, R N, Peoria, Illinois

Preparing Scientific Papers ALFRED W ADSON, M D, Rochester

Clinical Research FRANK E ADAIR, M D, New York

Discussion Led by JOSEPH R CLEMMONS, M D, New York

Wednesday, 2 00—Local Hospitals

Demonstrations of Administrative and Technical Procedures in Local Hospitals Anesthesia, Clinic Management, Nursing Service, Isolation Technique, Food Service, Medical Social Service, Simplified Economical Method of Preparing Sterile and Parenteral Solutions, Oxygen Therapy, Central Record Room and Follow-up System, Care of Chronic Patients

Thursday, 10 00—Sert Room, Waldorf-Astoria Hotel

R C BUECKI, M D, Madison, presiding

Symposium The Training of Hospital Executives

Need for Adequate Education and Training for Hospital Executives JAMES A HAMILTON, New Haven.

Discussion from the following viewpoints

Apprenticeship in Hospital Administration DONALD C SHELZER, M D, Philadelphia

Graduate and Undergraduate University Courses for Hospital Administrators GERHARD HARTMAN, Chicago

Institutes for Hospital Administrators NEAL N WOOD, M D, Chicago

Supplementary Training and Experience in Hospital Administration—Reading, Observation Tours, and Attendance at Meetings GEORGE A MACIVER, M D, Worcester

Discussion Led by E M BLUESTONE, M D, New York

Thursday, 2 00—Sert Room, Waldorf-Astoria Hotel

Administrative Panel Round Table Conference—a discussion of important questions and problems pertaining to all phases of hospital administration Conducted by Robert Jolly, Houston Administrative practices, anesthesia, business methods, clinical laboratory, group hospitalization, hospital personnel, house management, laundry, mechanical department of the hospital, medical records, medical social service, nursing service, occupational therapy, pharmacy, physical therapy, professional practice, trustees, voluntary service Discussion of questions or problems presented by the assembly.

PROGRAMS FOR EVENING SESSIONS

Presidential Meeting and Convocation—Monday 8 00 P M —Ballroom Waldorf Astoria Hotel

Processional—Officers, Regents, and Honorary Guests

Invocation

Address of Welcome HENRY W. CARR, M.D., New York, Chairman, Committee on Arrangements

Introduction of Foreign Guests FRANK W. LYNCH, M.D., San Francisco, Vice President

Address of Retiring President FREDERIC A. BESLEY, M.D., Waukegan

Inauguration of Officers

President HOWARD C. NAFFZIGER, M.D., San Francisco

First Vice President VERNON C. DAVID, M.D., Chicago

Second Vice President FRASER B. GURD, M.D., Montreal

Presentation of Initiates for Fellowship GEORGE CRILE, M.D., Cleveland, Chairman, Board of Regents

Conferring of Fellowships by the President HOWARD C. NAFFZIGER, M.D., San Francisco

Conferring of Honorary Fellowships The President

Medical Record Honor List and Prize Award The President

Annual Oration on Surgery Our College Mandate—A Tribute to Allen B. Kanavel WALTER W. CHIPMAN, M.D., Montreal

Tuesday 8 00 P M —Ballroom Waldorf Astoria Hotel

Recurrent Hyperthyroidism RICHARD B. CATTELL, M.D., Boston

Contractures Due to Burns, Their Prevention and Cure WILLIAM T. COLGHLIN, M.D., St. Louis

Results with Repeated Stomach Operations PROF. HANS FINSCHER, Vienna

Brooklyn Night—Wednesday 8 00 P M —Ballroom Waldorf Astoria Hotel

Address of Welcome DONALD L. MCKENNA, M.D., Brooklyn, Chairman, Brooklyn Long Island Committee on Arrangements, Presiding

The Radical Operation for Cancer of the Stomach W. H. OGILVIE, M.D., F.R.C.S. (Eng.), London
Regional Ileitis

Surgical Standpoint CHARLES G. MIXTER, M.D., Boston

Medical Standpoint B. B. CROHN, M.D., New York

Treatment of Bronchiectasis

Surgical Standpoint NORMAN S. SHENSTONE, M.D., Toronto

Medical Standpoint J. J. SINGER, M.D., Los Angeles

Thursday 8 00 P M —Ballroom Waldorf Astoria Hotel

Ulcerative Colitis FRED W. RANKIN, M.D., Lexington, Ky.

The Psychiatrist in Relation to Surgery FRANKLIN G. LEAUGH, M.D., Denver

Benign Strictures of the Bile Ducts with a New Method of Treatment GEORGE J. WILSON, M.B., Toronto

Fracture Oration The Evolution of Fracture Treatment ISIDORE COHEN, M.D., New Orleans

OPHTHALMOLOGY

Tuesday and Thursday 8 00 P M —Semi Room Waldorf Astoria Hotel

Graduate Training in Ophthalmology HARRY S. GRADLE, M.D., Chicago

A New Visual Phenomenon Useful as a Functional Test in Subjectively Studying Action of Eye Muscles and

Retina CLIFFORD B. WALKER, M.D., Los Angeles

Present Status of Lacrimal Sac Surgery RALPH O. RYCHENER, M.D., Memphis

OTORHINOLARYNGOLOGY

Tuesday and Thursday, 8 00 P M —Empire Room, Waldorf-Astoria Hotel

- The Phylogenetic Development of the Ear JAMES MILTON ROBB, M D , Detroit
 The Treatment of Otitic Meningitis Due to Streptococcic Infection by Radical Surgery and Sulfanilamide
 CARL H McCASKEY, M D , Indianapolis
 Graduate Training in Otolaryngology ALBERT C FURSTENBERG, M D , Ann Arbor, Mich.
 Surgical Treatment of Laryngeal Tuberculosis FLETCHER D. WOODWARD, M D , HALSTEAD S. HEDGES,
 M D , and FRANK B STAFFORD, M D , Charlottesville, Va.
 Analysis of the Mechanical, Surgical, and Therapeutic Aids to Hearing JAMES A BABBITT, M D , Phila-
 delphia

PROGRAMS FOR AFTERNOON SESSIONS

CANCER SYMPOSIUM

Tuesday, 2 00 P M —Ballroom, Waldorf-Astoria Hotel

- Surgical Treatment of Laryngeal Cancer GORDON B NEW, M D , Rochester, Minn
 The X-Ray Treatment of Inoperable Cancer of the Larynx HENRI COUTARD, M D , Chicago
 Evaluation of Ovarian Sterilization for Breast Cancer. GRANTLEY W TAYLOR, M D , Boston.
 Observations on Palliative Irradiation of Metastatic Tumors in the Lung ALEXANDER BRUNSCHWIG,
 M D , and ANNA HAMANN, M D , Chicago

SYMPOSIUM ON SURGICAL PROCEDURES ON THE HANDICAPPED PATIENT

Wednesday, 2 00 P M —Ballroom, Waldorf-Astoria Hotel

- Factors Determining Selection and Administration of Anesthetics WESLEY BOURNE, M D , Montreal
 Surgical Procedures on the Deeply Jaundiced Patient ROBERT S DINSMORE, M D , Cleveland
 Surgical Procedures on the Diabetic LELAND S MCKITTRICK, M D , Boston
 Medical Aspects in Pre-operative and Postoperative Care of Diabetic and Cardiac Patients JAMES E
 PAULIN, M D , Atlanta, Ga

SYMPOSIUM ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

Thursday, 3 00 P M —Ballroom, Waldorf-Astoria Hotel

- Importance of Dusts in Industry and Their Medical Control LEROY U GARDNER, M D , Saranac Lake, N Y
 Methods of Investigation of Occupational Skin Diseases LOUIS SCHWARTZ, M D , New York.
 Injuries to the Patella and Surrounding Tissues WILLIAM R CUBBINS, M D , Chicago
 Diagnosis and Therapy of So-called Posttraumatic Neurosis Following Cranioerebral Injuries DONALD
 MUNRO, M D , Boston
 Problems in Rehabilitation after Injury EDWARD C HOLMBLAD, M D , Chicago.
 Report of the 1938 Survey M N NEWQUIST, M D , Chicago

SYMPOSIUM ON FRACTURES

Friday, 2 00 P M —Ballroom, Waldorf-Astoria Hotel

- Postgraduate Education in Fractures GEORGE A LELAND, JR, M D , Boston
 The Kinetic Amputation HENRY H KESSLER, M D , Newark
 Double Pin Skeletal Fixation in Fractures of the Leg R ARNOLD GRISWOLD, M D , and GEORGE W
 HOLMES, M D , Louisville
 Fractures of the Bones of the Face JAMES B BROWN, M D , St. Louis
 Conservative Treatment of Fractures ELDRIDGE L ELIASON, M D , Philadelphia

SYMPOSIUM ON OBSTETRICS AND GYNECOLOGY

Friday 2 00 P M —Sert Room Waldorf Astoria Hotel

- Certain Aspects of So called Sterility ARCHIBALD D CAMPBELL, M D Montreal
 Experience with the Melhado Maneuver for Persistent Posterior Position GEORGE M WHITE, M D
 St John N B
 Ovarian Hormones and Carcinogenesis LUDWIG A FENCE M D, San Francisco
 The Management of Uterine Prolapse by Multiple Plastic Procedures EDWARD A SCHULMAN M D,
 Philadelphia
 Wertheim Operation for Cancer of the Uterus PROF PAUL WEPNER Vienna

SYMPOSIUM ON UROLOGIC INFECTIONS

Friday 2 00 P M —Le Perroquet Suite, Waldorf Astoria Hotel

- Obstructive Uropathies ALEXANDER RANDALL M D Philadelphia
 Problems in Differential Diagnosis between Urologic Lesions and Abdominal Lesions HERMAN L KRETZCH
 M D, Chicago
 Renal Infections and Nephrolithiasis GEORGE G SMITH, M D Boston
 Pyelonephritis and Its Treatment WILLIAM F BRAASCH M D Rochester Minn

MIDDAY ROUND TABLE CONFERENCES

12 00 M to 1 00 P M —Waldorf Astoria Hotel

TUESDAY

Jansen Suite

- Infections in Surgery MONT ROGERS PEID M D Cincinnati Presiding
 Collaborators DEAN LEWIS M D Baltimore UPRAN MAES M D New Orleans MICHAEL I
 MASON M D Chicago ALLEN O WHIPPLE M D New York

Blue Room

- Shock ALFRED BLALOCK M D Nashville Presiding
 Collaborators WILLIAM DEWITT ANDRUS M D New York NORMAN E FREEMAN, M D Phila
 delphia CARL H LENTHAFT M D, Cleveland DALLAS B PHENISTER M D Chicago

Carpenter Suite

- The Immediate Repair of Cutaneous Defects SUMNER I KOCH M D Chicago Presiding
 Collaborators JAMES B BROWN M D St Louis EARL C PADGETT M D Kansas City Mo
 GEORGE WARREN PIERCE M D San Francisco JEROME P WEBSTER M D New York

Assembly Suite

- Thoracic Surgery WILLIAM F RIENHOFF JR M D Baltimore Presiding
 Collaborators NORMAN S SHENSTONE M D Toronto WALTER FRYELL LEE M D Philadelphia

WEDNESDAY

Blue Room

- The Choice of Anesthetic JOHN S LEADY M D Rochester Minn Presiding
 Collaborators WESLEY BOURNE M D Montreal WILLIS D CATCH M D Indianapolis RALPH
 M WATERS M D Madison Wis

Jansen Suite

Craniocerebral Injuries CLAUDE C COLEMAN, M D , Richmond, Presiding
 Collaborators: B NOLAND CARTER, M D , Cincinnati, DONALD MUNRO, M D , Boston

Empire Room

The Surgical Problem of Hypertension LOYAL DAVIS, M D , Chicago, Presiding
 Collaborators. ALFRED W. ADSON, M D , Rochester, Minn , GEORGE J HEUER, M D , New York,
 IRVINE HEINLY PAGE, M D., Indianapolis, REGINALD H SMITHWICK, M D., Boston

Assembly Suite

The Operative Treatment of Hyperparathyroidism. EDWARD D CHURCHILL, M D , Boston, Presiding
 Collaborators JAMES D BARNEY, M D , Boston, DALLAS B PHEMISTER, M D , Chicago

FRIDAY

Le Perroquet Suite

The Treatment of Open Wounds ROY D. McCCLURE, M D., Detroit, Presiding
 Collaborators L KRAEER FERGUSON, M D., Philadelphia, EDWARD L HOWES, M D , Washington,
 MONT ROGERS REID, M D., Cincinnati

Jansen Suite

The Prevention of Postoperative Pulmonary Complications EMILE HOLMAN, M.D , San Francisco,
 Presiding
 Collaborators CLAUDE S BECK, M D , Cleveland, ELLIOTT C CUTLER, M D , Boston, WILLIAM F
 RIENHOFF, JR , M D , Baltimore

Assembly Suite

Infections in Obstetrics JOHN FRASER, M D., Montreal, Presiding
 Collaborators FRED L ADAIR, M D , Chicago, ALFRED C. BECK, M D , Brooklyn, GEORGE W KOS-
 MAK, M D., New York; ARTHUR H MORSE, M D , New Haven

Blue Room

Cancer of the Prostate HUGH H YOUNG, M D , Baltimore, Presiding
 Collaborators HARRY CULVER, M D , Chicago, FREDERIC E B FOLEY, M D , St Paul, GEORGE G.
 SMITH, M D , Boston

ASSEMBLY OF INITIATES

Monday, 3 00 P M —Ballroom, Waldorf-Astoria Hotel

Processional—Initiates, Officers, Regents, and Governors
 Opening Remarks FREDERIC A BESLEY, M D , Waukegan, President
 The Program of the American College of Surgeons
 IRVIN ABELL, M D , Louisville, Vice Chairman, Board of Regents
 BOWMAN C CROWELL, M D , Chicago, Associate Director
 MALCOLM T MACEachern, M D , Chicago, Associate Director
 The Fellowship Pledge Recital by Initiates
 Greetings to the Initiates HOWARD C. NAFFZIGER, M D , San Francisco, President-elect
 Closing Remarks GEORGE CRILE, M D , Cleveland, Chairman, Board of Regents.
 Signing of the Fellowship Roll by the Initiates
 Reception to Initiates and Fellows

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS GENERAL SURGERY, OBSTETRICS AND GYNECOLOGY, SURGERY OF BONES AND JOINTS, GENITO URINARY SURGERY, FRACTURES AND TRAUMATIC SURGERY, THORACIC SURGERY, NEUROSURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, OPHTHALMOLOGY, OTOLARYNGOLOGY

NEW YORK—GENERAL SURGERY

Monday

BELLEVUE HOSPITAL

E. A. ROVENSTINE and staff—2 Symposium on anesthesia
Anesthetic management of patients with hyperactive carotid sinus reflects therapeutic nerve blocks for angina intractable pain etc demonstration of the technique of oropharyngeal insufflation of oxygen

BETH ISRAEL HOSPITAL

HARRY E. ISAACS and staff—2 Operations with particular reference to diseases of the gall bladder Dry clinic
Cholecystectomy without drainage common duct obstruction resectable liver tumors

FLOWER FIFTH AVENUE HOSPITAL

J. H. FOWES and associates—Tumor clinic
THOMAS MCGAVACK Lymphosarcoma
J. C. HOWARD Hodgkins disease
J. BORSELLI and W. BOULAND
THOMAS MCGAVACK Medical aspects of suprarenal tumors
I. R. KAUFMAN Surgical aspects of suprarenal tumors
I. C. REID and F. D. SPEER Pathology
G. A. ADLER Endocrine aspects
J. H. FOWES Report of angiosarcoma of the cauda equina intensive x-ray treatment and operation result at end of 21 years with presentation of patient
J. H. FOWES W. BOULAND and J. C. HOWARD Symposium on breast cancer
J. H. FOWES D. B. HILL J. C. HOWARD and W. BOULAND Fibrolipoma of the cecum with intussusception fibroma of the rectum

FORDHAM HOSPITAL

E. R. CLUNYFFE R. F. WALSH and ALFRED G. FORMAN—2
Operative and dry clinics

GOVERNEUR HOSPITAL

R. F. CARTER and R. B. LOBBAN—2 Diagnosis and surgical management of gall bladder disease

HARLEM HOSPITAL

LOUIS T. WRIGHT—2 Operations and ward rounds
CLARENCE P. HOWLEY—2 Operations and ward rounds

LEFVON HILL HOSPITAL

CARL FOKERS OTTO C. PICKHARDT DEW. STETTIN and staffs—2 Operations
Staff—2 Symposium on gastric and duodenal ulcer and associated lesions
WILLIAM H. STEWART Roentgen diagnosis of peptic ulcer by the modern mucosal method
MAX ENBORN Intubation treatment of peptic ulcer
ABRAHAM L. CARBAT Ambulatory treatment of peptic ulcer

HENRY A. RAFFERTY Medical treatment of pyloric obstruction

CARL EGGERS Gastro-enterostomy in peptic ulcer
DEW. STETTIN End results after resection for peptic ulcer
OTTO C. PICKHARDT Treatment of associated lesions
HERMANN FISCHER—Exhibition of mouldings of pathological specimens of gastro-intestinal tract

METROPOLITAN HOSPITAL

S. T. GLASSER and A. LESSER—1 30 Injection treatment of varicose veins

MISERICORDIA HOSPITAL

ARTHUR S. MCQUILLAN—2 Symposium on thyroid gland surgery study of 2,000 cases
WILLIAM T. DORAN SR—3 30 Surgical judgment in procedures of the upper abdomen

MOUNT SINAI HOSPITAL

RALPH COLE PERCY KILGENSEN SIGMUND MACE and JOSEPH STENBUCK—1 15 Operations Dry clinic
Pancreatic reflux palliative subtotal gastrectomy for juxtaparacardial gastric ulcer study of failures after gastro-enterostomy

NEW YORK CITY HOSPITAL

LYMAN W. CROSSMAN and JAMES H. FINDER—2 Operations

NEW YORK FOUNDLING HOSPITAL

GEORGE R. STUART and staff—2 Unusual surgical cases
etiological pathological and surgical aspects

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

EDWARD W. PETERSON—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

FRANK C. YEOMANS—1 30 Proctological operation

ST. LUKE'S HOSPITAL

Staff—2 30 Symposium on thyroid diseases
C. L. GILBERT Radiotherapy in toxic goiter
F. HERBERT JR Incidence of malignancy in solitary adenoma of thyroid
M. K. SMITH Amount of remnant in operations for diffuse toxic goiter
C. M. GOODWIN Discussion of postoperative tetany

Scientific Exhibitions—Daily

Tumor exhibit F. C. W. Director Department of Pathology
New growths of the respiratory and gastro-intestinal tracts J. J. RYAN Director Department of X-Ray Diagnosis

SAINT VINCENT'S HOSPITAL

MAURICE C O'SHA—2. Severed tendons and nerves of the hand and forearm

ANTHONY ROTTINO—2 Pathological demonstration

SYDENHAM HOSPITAL

MILTON BODENHEIMER—2 Operations Various types of thyroid disease

Tuesday

BABIES HOSPITAL

EDWARD J DONOVAN, WILLIAM G HEEKS, LOUIS M ROUSSELOT, and GEORGE H HUMPHREYS—9 Operations

Dry Clinics

EDWARD J DONOVAN Congenital duodenal obstructions

WILLIAM G HEEKS Treatment of acute empyema

LOUIS M ROUSSELOT Treatment of general peritonitis in children

GEORGE H HUMPHREYS Retroperitoneal infections in children

BELLEVUE HOSPITAL

ARTHUR BURDICK and staff—9 30 Operations

J A MCCREERY and staff—9 30 Operations

GUILFORD DUDLEY and staff—9 30 Operations

Staff—2 Symposium on surgical diseases of the stomach

JACOB BUCKSTEIN Roentgenologic diagnosis of gastric, duodenal and gastric jejunal ulcers

JOHN A MCCREERY Operative management of secondary gastric and duodenal ulceration including marginal ulcers

GUILFORD S DUDLEY Inflammatory and benign tumors of the stomach and their surgical management

ARTHUR M WRIGHT, FRANCES BOGATKA, and WILLIAM BARBER Failures after gastrojejunostomy, clinical and experimental studies

ROLAND L MEIER Treatment of gastric ulcer

REYNOLD E CHURCH Surgical treatment of massive hemorrhage

J WILLIAM HINTON Surgical treatment of chronic duodenal ulcers

FLOWER-FIFTH AVENUE HOSPITAL

HERBERT CHASE—9 Breast operations and motion pictures

H D FURNESS and W P ECKES—9 Cases of intestinal obstructions

EARL EATON and L PALERMO—9 Treatment of burns with horse serum and tannic acid

W G CRUMP—9 Carcinoma of rectum

J H FOBES—9 Carcinoma of colon

J A SILEO—9 Thrombosis and embolism, postoperative care

L R KAUFMAN and J H FOBES and staffs—2 Operations

FORDHAM HOSPITAL

E R CUNNIFFE, R E WALSH, and ALFRED G FORMAN—2 Operative and dry clinics

GOUVERNEUR HOSPITAL

F M CONWAY—9 Diverticulitis of the colon

M BERCK—9 Diagnosis and treatment of penetrating wounds of the esophagus

JOSEPH GIRDANSKY—2 Injection treatment of hernia and varicose veins

HARLEM HOSPITAL

JOSEPH B STENBUCK—9 Operations and ward rounds

LEON GINZBURG—9 Operations

CHARLES S B CASSASA, JOSEPH B STENBUCK, FARROW R ALLEN, IRA FINK, ROBERT E CARTER, NORMAN F LASKEY, WILLIAM H MENCHER, BENJAMIN N BERG, FRANCIS X TIMONEY, JOHN R BRUCKNER, ROBERT S WILKINSON, and WILLIAM SNOW—10 30 Symposium on subcutaneous and penetrating wounds of the thorax and abdomen

HOSPITAL FOR JOINT DISEASES

MILTON BODENHEIMER and staff—9 Operations Thyroid surgery

ABRAHAM J BELLER and staff—9 Operations Gastrectomy for carcinoma of the stomach, abdominoperineal resection for carcinoma of the rectum

HARRY GOLDMAN and staff—9 Proctological operations

KNICKERBOCKER HOSPITAL

GEORGE H SEMKEN—9 The cancer problem Symposium with lantern slides

LENOX HILL HOSPITAL

Staff—9 Dry clinic Affections of the thyroid gland and complications

ARTHUR F KRAETZER General survey of thyroid disease

JACOB GEIGER Value of basal metabolism tests in thyroid disorders

A S BLUMGARTEN Medical treatment of thyroid disorders and associated endocrine disturbances, including diabetes

THOMAS K DAVIS The psychiatric manifestations in hyperthyroidism

CLARENCE DE LA CHAPELLE Cardiovascular problems in the thyroid diseases

PAUL K SAUER The thyroid in relation to heart disease

WALTER T STENSON Postoperative care of patients with hyperthyroidism

ERICH FRICKE Postoperative results in cases with hyperthyroidism

FRANCIS M DONEHUE Postoperative tetany and its treatment

OTTO C PICKHARDT The use of A T 10 in postoperative tetany

CARL EGGERS—2 Esophageal lesions with demonstration of patients

WM H STEWART and staff—2 Cinefluorographic demonstration of esophageal lesions

HERBERT W MEYER—2 Reconstruction operations for epithelioma of the face

ARTHUR STEIN—2 Lesions of the vulva, lantern slides

LINCOLN HOSPITAL

KIRBY DWIGHT—9 Operations on the colon Dry clinic peritonitis and ileus

FREDERICK H AMENDOLA, SAMUEL EPSTEIN, and REUBEN GILBERT—11 15 Diseases of the thyroid

LUTHERAN HOSPITAL

ALFRED G FORMAN and staff—9 Operations

Staff—2 Dry clinic

JOHN P BRUCKNER Ludwig's angina

CHARLES S CASSASA Intestinal obstruction

ANGELO A ZINGARO Epiphyseal fracture

LOUIS PEROTTA Technique of spinal anesthesia and end results

MEMORIAL HOSPITAL

BRADLEY COLEY—9 Amputation of leg for osteogenic sarcoma

FRANK E ADAIR—10 Radical amputation of breast for carcinoma

METROPOLITAN HOSPITAL

- J H FOBES and L R KAUFMAN and staffs—9 Symposium Surgery of the stomach liver spleen and pancreas
 T B WEINBERG Roentgenological aspects
 Dr McNEILL Gastroscopy
 LINN J BOYD and THOMAS H MCGAVACK Medical aspects
 J H FOBES and L R KAUFMAN Operations
 J H FOBES and JOHN S O HERRLIN JR Demonstration of cases of pancreatic cysts
 ROY UPHAM D B HILL and staffs Medical aspects of gastric ulcer
 Staff—130 Symposium on gastro-intestinal surgery
 D B HILL, J H FOBES and J C HOWARD Lesions of the lesser curvature of the stomach medical aspect surgical aspect, motion pictures and lantern slides
 ROY UPHAM J C HOWARD A SACCOVE and L R KAUFMAN General management of gastric and duodenal ulcer medical aspect roentgenological and pathological aspects surgical treatment
 CHARLES A HALBERSTAM EDWARD J McCABE and W W JOHNSON Report on perforation of gastric and duodenal ulcers
 L R KAUFMAN J H FOBES JOHN S O HERRLIN JR WILLIAM P ECKES and EDWARD J McCABE The jaundice problem report by the complete surgical staff
 J H FOBES and staff Report of two cases of solitary liver abscess
 H D FURNISS and W P ECKES Intestinal obstruction
 JOHN S O HERRLIN JR Discussion of the water balance in treatment

MISERICORDIA HOSPITAL

- SAUL A RITTER—7030 Tuberculosis of ileocecal valve simulating malignancy and other unusual surgical cases.
 LESTER BREIDENBACH—2 Phlebectomy for thrombosis
 MAURICE J COSTELLO—3 Surgical neoplasms of skin
 PETER RIZZO—330 Devices in skeletal surgery

MONTEFIORE HOSPITAL

- A A BERG and staff—2 Operations on the colon

MORRISANIA CITY HOSPITAL

- J LEWIS AMSTER—9 Operation demonstrating regional anesthesia

NEW YORK CITY CANCER INSTITUTE

- IRA I KAPLAN and associates—2 Symposium on cancer
 IRA I KAPLAN Treatment of carcinoma of the cervix in advanced cases
 ABRAHAM H GOLDEN Palliative mastectomy
 GEORGE A CASHMAN Genito urinary malignancy especially carcinoma of the penis
 RUDOLPH V GORSCH Colostomy
 ANGELO M SALA Pathology of advanced malignancy
 DAVID E FERLICH Pendant mastography in the diagnosis of carcinoma of the breast.

NEW YORK CITY HOSPITAL

- FREDERIC BANCROFT and MARGARET STANLEY BROWN—9 Thrombosis thrombophlebitis embolism

NEW YORK HOSPITAL

- GEORGE J HEUER and staff—9 Operative and dry clinics
 GEORGE J HEUER Surgical treatment of hypertension
 WILLIAM DEW ANDRUS Splenectomy
 WILLIAM F MACFEE Surgical lesions of the mouth and jaws

- RALPH F BOWERS Results in 900 thyroidectomies
 BRONSON S RAY Organization of a follow up department.
 N CHANDLER FOOT Contribution of a laboratory of surgical pathology to a surgical service
 FRANK GLENN Surgery of common bile duct

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

- ANNA HUBERT MARY L EDWARD and FRANCES BOGATKO
 —9 Surgical follow up clinic
 ELISE L ESPERANCE—2 Tumor conference

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

- CARL EGGERS—9 Breast clinic (Skin and Cancer unit)
 THOMAS H RUSSELL—2 Operations

NEW YORK POLY CLINIC MEDICAL SCHOOL AND HOSPITAL

- FREDERICK C KELLER—10 Cadaver demonstration (surgical anatomy)
 ROBERT E BRENNAN—11 Operations
 JEROME M LYNCH—130 Operations proctological
 RICHARD KOVACS—230 Lecture on physical therapy
 EDWARD L KELLOGG—330 Operations

PRESBYTERIAN HOSPITAL

- ALLEN O WHIFFLE and LOUIS M ROUSSELOT—9 Splenectomy
 WILLIAM BARCLAY PARSONS and LAWRENCE W SLOAN—9 Thyroid operations
 WALTER W PALMER WILLIAM BARCLAY PARSONS LAWRENCE W SLOAN BERTRAM J SANGER and ARTHUR P STOUT—10 Symposium on thyroid disease
 ALLEN O WHIFFLE WILLIAM P THOMPSON KENNETH R. MACALPIN R WEST LOUIS M ROUSSELOT and ROBERT H E ELLIOTT—2 Symposium on blood dyscrasias and splenopathies

ROOSEVELT HOSPITAL

- Staff—9 Symposium on surgical management of intractable ulcerative colitis
 THOMAS T MACKIE Medical aspects
 HENRY W CAVE Operation with discussion
 LAWRENCE SOPHIAN Pathological aspects
 Staff—2 Symposium on ulcers and carcinoma of the stomach.
 HOWARD F SHATTUCK Medical aspects
 WILLIAM H BOONE Roentgen Diagnosis
 CONDUCT W CUTLER JR Indications for surgical treatment
 CORDON P MCNEER Demonstration of gastroscopy
 GRANT P PENNOYER and JULIAN M FRESTON—330 Demonstration of various types of peripheral vascular diseases with differential diagnosis and the results of treatment

SAINT FRANCIS HOSPITAL

- ALFVANDER NICOLL and staff—9 Cholecystectomy cholecystectomy with exploration of common duct.
 CHARLES VEJVODA and staff—9 Cholecystectomy appendectomy hemorrhaphy

ST LUKE'S HOSPITAL

- HENRY H M LYLE JOHN DOUGLAS EDWARD J DONOVAN WILLIAM F MACFEE MORRIS K SMITH and staff—9 Operative and dry clinics
 B K SROKE Surgical treatment of epitheliomas of the face

WILLIAM F MACFEE Obstruction of the small intestines
E D TRUESDELL The prognosis in silent gallstones
EDWARD J DONOVAN Congenital diaphragmatic hernia
WILLIAM G HEEKS and WILLIAM T GIBB, JR The value
of gastroscopy in diagnosis, demonstration of gastro-
scopy

SAINT VINCENT'S HOSPITAL

JOSEPH A BRADY, GEORGE R STUART, HARRY V WALSH,
FRANK J. MCGOWAN, BERNARD D HANNAN, and
FRANCIS X TIMONEY—9 Operations
RAYMOND P SULLIVAN, CONSTANTINE J MACGUIRE, JR,
LOUIS F SANMAN, CLARENCE P HOWLEY, and JOHN H
MORRIS—9 Operations

SYDENHAM HOSPITAL

MILTON BODENHEIMER—3 Dry clinic Stab and bullet
wounds of the chest and abdomen

UNITED STATES MARINE HOSPITAL

L A PALMER and staff—10 30 Symposium on gastric
surgery
L A PALMER and staff Surgical aspects
C R SMITH Pathological aspects
F LIBERSON X-ray reports
J A BRASFIELD and J KELMAN—10 30 Symposium on
back injuries Surgical aspects, neuropsychiatric
aspects
H KELMAN and S P COOPER—2 Symposium on peri-
pheral vascular disease
L A PALMER and staff—2 Operative and dry clinic
Hernia

Thursday

BEEKMAN HOSPITAL

Staff—9 Symposium on abdominal emergencies from
various clinical viewpoints, ward rounds
ARTHUR H TERRY, JR The acute abdomen in the diabetic
ROBERT H KENNEDY Ovarian conditions contributing to
an acute abdomen
SIGMUND MAGE Retroperitoneal injury simulating acute
abdomen
JAMES H HEYL Pseudopancreatic cyst following ab-
dominal trauma
ELIAS RUBIN Genito urinary tract injuries
CHARLES J OPPENHEIM Coronary thrombosis
THOMAS M LOWRY Acute allergic abdomen
MYRON A SALLICK Perforated peptic ulcer

BELLEVUE HOSPITAL

Staff—9 30 Symposium on surgery of the thyroid
RODERICK V GRACE and CARNES WEEKS Total thy-
roidectomy for heart disease, four-year results, pro-
gressive exophthalmus following Graves' disease,
aberrant thyroid, two cases, interval surgery in the
patient with hyperthyroidism
RUSSELL H PATTERSON Prevention and treatment of
complications in goiter surgery
H M WERTHEIM Demonstration of cervical plexus
anesthesia block, lantern slides
H A D O'CONNOR and JOSEPH NASH Evaluation of
postoperative thyroid results
ARTHUR S MCQUILLAN Ossification of a thyroid adenoma,
Huerthle-cell tumor of the thyroid gland, Hashimoto's
disease of the thyroid gland, epithelioid carcinoma of the
thyroid gland, hyperparathyroidism, postoperative
tetany, treatment
ARTHUR WRIGHT and staff—9 30 Operations

FENWICK BEEKMAN and staff—2 Symposium on children's
surgery Treatment of fractures, congenital anomia,
burns, problem cases
IRA I KAPLAN, RIEVA ROSH, DOROTHY BELL, MILTON
FRIEDMAN, and SIDNEY RUBENFELD—2 Demonstra-
tions of treatment of malignant and benign lesions with
irradiation, both x-ray and radium

FLOWER-FIFTH AVENUE HOSPITAL

L R KAUFMAN and J H FOBES and staffs—2 Operations
J H FOBES and associates—2 Symposium on gastro-
intestinal surgery, lesions of the lesser curvature of the
stomach
D B HILL Medical consideration
J H FOBES and J C HOWARD Surgical consideration,
motion pictures and lantern slides, general management
of gastric and duodenal ulcer
ROY UPHAM Medical consideration
J C HOWARD Roentgenology
L C REID Pathology
L R KAUFMAN Surgery
CHARLES A HALBERSTAM, EDWARD J MCCABE, and
WILLIAM WARNER JOHNSON Report of perforation of
gastric and duodenal ulcers
J H FOBES, L R KAUFMAN, JOHN S O HERRLIN, JR,
W P ECKES, and EDWARD J MCCABE The jaundice
problem
H D FURNESS and W P ECKES Intestinal obstructions
JOHN S O HERRLIN, JR Discussion of water balance

FORDHAM HOSPITAL

ALEXANDER NICOLL, JAMES KENYON, and LOUIS MARTON
—9 Operative and dry clinics
ALEXANDER NICOLL, JAMES KENYON, and LOUIS MARTON
—2 Operative and dry clinics

GOUVERNEUR HOSPITAL

J F ERDMAN—9 Operations

HARLEM HOSPITAL

RALPH H YOUNG—9 Operations
CHARLES S B CASSASA—9 Operations
LOUIS T WRIGHT, JOSEPH G LEVY, SOLOMON WEINTRAUB,
FREDERICK A KASSEBOHM—10 Symposium on
lymphopathia venereum

HOSPITAL FOR RUPTURED AND CRIPPLED

CARL G BURDICK and associates—9 Symposium on
hernia
JOHN E SULLIVAN Postoperative complications
ROBERT V GRACE and VANSEL S JOHNSON Results of
herniotomy in patients over fifty years of age
FENWICK BEEKMAN Undescended testicle
NORMAN L HIGINBOTHAM Division of cord
BRADLEY L COLEY Injection treatment
DAVID GILLESPIE Fascial sutures in the repair of hernia
ROLAND L MAIER Silk sutures in the repair of hernia

LENOX HILL HOSPITAL

OTTO C PICKHARDT, CARL EGGERS, DEW STETTEN and
staffs—9 Operations

LINCOLN HOSPITAL

EDWARD D TRUESDELL—9 Operations on biliary tract
CHARLES S ROGERS—10 30 Dry clinic Children's
surgery
JAMES R LINCOLN, JACOB FRIEDMAN, and LEONARD
ORENS—11 15 Surgical complications of diabetes

MEMORIAL HOSPITAL

GEORGE BINALEY—9 Resection for carcinoma of rectum
 GEORGE T. PACE—9 Resection for gastric carcinoma
 Staff—11 Cancer conference

METROPOLITAN HOSPITAL

THOMAS H. MCGAVACK CHARLES A. HALBERSTAM S. T. GLASSER and A. LESSER—9 Peripheral vascular diseases with demonstration of arteriography oscillography Landis test and histamine test
 DAVID WEEKS and associates—9 Report on experimental work in the production of renal hypertension and operative procedures for relief
 J. H. FOBES L. R. KAUFMAN and staff—9 Operations

MOUNT SINAI HOSPITAL

JOHN H. GARLOCK LEON GINSBURG WILLIAM H. MENCHER and MOSES SWICK—15 Operations
 Colonic surgery obstructive jaundice Dry clinic
 Ulcerative colitis carcinoma of the esophagus

NEW YORK CITY HOSPITAL

P. K. SAUER and staff—9 Operative and dry clinics
 LESTER BLUM—9 Experimental cardiac surgery
 W. G. TERVILLIGER—9 Varicose veins
 ROBERT T. FINDLAY—9 Surgery in the poor risk aged

NEW YORK HOSPITAL

GEORGE J. HEUER and staff—9 Operative and dry clinics
 IRANK GLENN Acute cholecystitis
 WILLIAM F. MACFEE Carcinoma of the large bowel
 RALPH F. BOWERS Terminal ileitis
 CRANSTON W. HOLMAN Pre and postoperative studies of gastric secretion
 WILLIAM A. COOPER Carcinoma of the ampulla of Vater
 HERBERT CONWAY Leiomyosarcoma of the stomach

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNA HUBER MARY JENNINGS and ISABEL KNOWLTON—9 Operations
 FRANCES BOGATLO—9 Varicose vein clinic

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

CARL EGGERS—9 Dry clinic Surgery of the head and neck
 CHARLES G. HEID—9 Operations
 EDWARD W. PETERSON—9 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

JOHN J. McGRATH—11 Operations
 VINCENT HUCKLEY—130 Proctology cadaver demonstration
 J. E. HAMMETT—130 Operations

PRESBYTERIAN HOSPITAL

BEVERLY C. SMITH DAVID C. BILL LOUIS BACHMAN and BYRON STOKES—9 Operations Symposium on vascular disturbances of the extremities
 JOHN M. HANFORD ARTHUR I. STOUT CISHMAN D. HAAG EMMET MAURICE LEVI and THEODORE P. EBERHARD—2 Symposium on therapy of tumors of head and neck

ROOSEVELT HOSPITAL

HOWARD A. PATTERSON—9 Thyroid clinic Followed by demonstration of cases with discussion of recurrent and persistent hyperthyroidism

WILLIAM CRAWFORD WHITE—9 Demonstrations of cases of carcinoma of the thyroid gland with discussion of treatment
 LEWIS H. BOOTH MALCOLM H. MCKITTRICK, and PAUL M. WOOD—2 Demonstration of modern trends in anesthesiology

SAINT FRANCIS HOSPITAL

ROBERT B. LOBBAN and staff—9 Subtotal gastrectomy stomach cases

ST. LUKE'S HOSPITAL

HENRY H. M. LYLE JOHN DOLGAS EDWARD J. DONOVAN WILLIAM F. MACLEZE MORRIS K. SMITH and staff—9 Operations

SAINT VINCENT'S HOSPITAL

EDWARD V. DENNEN FRANK J. SERAFIN WILLIAM P. MACNAMARA HENRY A. WARY and JAMES F. BROWN—9 Operations
 RAYMOND P. SULLIVAN JOHN A. LAWLER MAURICE C. O'SHEA THOMAS C. CASE FRANCIS M. CONWAY and JOHN A. FALLON—9 Operations
 RAYMOND P. SULLIVAN—2 Malignant and non malignant lesions of colon surgical aspects
 WILLIAM W. MAVER X-ray demonstrations
 ANTHONY ROTTINO Pathological demonstration
 CLARENCE P. HOWLEY—245 Diaphragmatic hernia
 JOHN A. LAWLER—245 Paraduodenal and paravascular hernias
 FRANK J. MCGOWAN—330 Operative procedure for perforated ulcer
 EDWARD V. DENNEN—330 Five year operative experience
 J. RAYMOND LUTZ—330 Medical management
 JOHN H. MORRIS—330 Follow up experience

SIDENHAM HOSPITAL

CULLEN ADLERBLUM—9 Dry clinic Varicose vein injections
 MEYER H. FREUND—1030 Operations Perineal excision of the rectum for carcinoma anorectal operations
 LESTER J. UNGER—230 Operations Blood transfusion—Unger method

UNITED STATES MARINE HOSPITAL

Staff—1030 Symposium on appendicitis
 L. A. PALMER and staff Surgical aspects
 C. R. SMITH Pathological aspects
 J. W. KENNEDY X-ray findings
 C. FERGUSON and R. MEE—1030 Symposium on rectal surgery
 S. P. COOPER—1030 Hernia operations

VETERANS ADMINISTRATION HOSPITAL

FREDERICK W. BANCROFT—9 Operations Gastric resection for pyloric obstruction 2 cases Discussion of thrombosis and embolism
 ALLEN G. FULLER—9 Operations Carcinoma of the rectum second stage
 H. J. BALLEW E. P. HALL and J. P. DELANEY—10 Operations Inguinal hernia repair with demonstration of sliding bladder 2 cases and result cases stomach and intestinal nonmalignant
 DEFOREST BALLOU JR.—10 Operations Laryngofissure partial laryngectomy Dry clinic Carcinoma of the larynx
 B. F. HAYDEN Manager CARLETON BATES Clinical Director JAMES EWING FRANK F. ADAMS and IRVING STEWART Consultants—2 Tumor conference

ALLEN G FULLER Carcinoma of the stomach
 E LEVY Carcinoma of the lung
 J P PALMER Carcinoma of lip and tongue
 W G CHRISTOFFERSEN Basal cell carcinoma and carcinoma of the rectum
 CHARLES F BLOOM Collaborated material
 R C HENDERSON Collaborated material
 DEFORREST BALLOU, JR Carcinoma of the larynx
 H HERSCHER Hodgkins disease and lymphosarcoma

Friday

BELLEVUE HOSPITAL

Staff—9 30 Symposium on gall bladder surgery.
 CONSTANTINE J MCGUIRE Treatment of acute cholecystitis
 FRANK COTUI Intravenous medication in gall bladder disease
 IRA I KAPLAN Radiation therapy in disease of the biliary tract
 WILLIAM T DORAN Management of the gall-bladder patient
 ERNEST W LAMPE Acute pancreatitis in relation to biliary tract disease
 JOHN E SUTTON, JR Jaundice and common duct stone

BETH ISRAEL HOSPITAL

PERCY KLINGENSTEIN and staff—2 Operations Graves' disease, gastroduodenal ulcer Dry Clinic Pre-operative radiation in carcinoma of the breast
 I KROSS—2 Dry clinic Obstructive lesions of the small intestine Case presentations
 SAMUEL MUFSON—2 Dry clinic Unusual pre-operative complications of hernia

WILLIAM BOOTH MEMORIAL HOSPITAL

WILLIAM T KENNEDY—9 Surgical treatment of incontinence of urine in women
 JOHN ROGERS and ARTHUR MCQUILLAN—10 Thyroid clinic
 GEORGE KOSMAK and N GILBERT SLYMOUR Demonstration of medical and surgical facilities in a small private hospital run by the Salvation Army for people of moderate means

FLOWER-FIFTH AVENUE HOSPITAL

J C HAYNER, DEW R S BARNES, and W L PRIMACOVE—9 The use of lemon oil as a skin antiseptic
 JOHN S O HERRLIN, JR—9 Infections of the hand, wax models, motion pictures
 J H FOBES and L R KAUFMAN and staffs—2 Operations
 J H FOBES and S T GLASSER—2 The use of ox fascia in hernia operations
 J C HAYNER—2 Demonstration of new method in hernia operations
 L R KAUFMAN and W W JOHNSON—2 Demonstration of wire sutures
 W W JOHNSON and A LESSER—2 Experimental work on dogs
 J D NORRIS—2 Studies in wound healing—dehiscence
 DAVID WEEKS and associates—2 Symposium on hypertension Report on experimental work in the production of the renal type and operative procedures for relief
 WILLIAM H BISHOP and J H FOBES—2 Intussusception of appendix, outside of anus-removal, demonstration with lantern slides
 J H FOBES, CHARLES HALBERSTAM and staff—2 The present status of appendicitis, demonstration of a new operation, motion pictures

DONALD E BRACE and staff—2 Contribution of a department of anesthesia to a surgical service
 L C REID—2 Contribution of a laboratory of surgical pathology to a surgical service

FRENCH HOSPITAL

ARTHUR M WRIGHT and staff—9 Symposium on diseases of the gall bladder Cholecystitis in elderly people treated by cholecystgastrostomy, stone in the common duct, poor operative risk, cholecystgastrostomy, patient living ten years later, choledochoduodenostomy for recurrent obstruction of common bile duct, rubber tube implantation, five months, resection of sigmoid for carcinoma complicated by intestinal obstruction by gall stones, pathological discussion by Dominic Anthony DeSanto

FORDHAM HOSPITAL

E R CUNNITFE, R E WALSH, and ALFRED G FORMAN—2 Operative and dry clinics

GOVERNEUR HOSPITAL

M ELIAS—2 Perforated gastric and duodenal ulcer.
 F J MCGOWAN—2 Discussion of above
 BORIS KORNBLITH—2 Lymphogranuloma venereum

HARLEM HOSPITAL

Staff—9 Dry clinics
 CHARLES S B CASSASA, ALEXANDER ALTSCHUL and staff Thyroid disease
 LEON GINZBURG Intestinal obstruction
 JAMES C WHITAKER Fat embolism
 AUBRE DEL MAYNARD Treatment of burns
 U CONRAD VINCENT Surgical lesions of the terminal ileum, cecum, and the ascending colon

KNICKERBOCKER HOSPITAL

JOHN V BOHRER, C JOSEPH DELANEY and PRO V PREWITT—9 Operative and dry clinic Surgery of the stomach and gall bladder

LENOX HILL HOSPITAL

Staff—10 30 Symposium on lesions of the colon
 WILLIAM H STEWART Differential diagnosis between carcinoma, diverticulitis and sigmoiditis
 CARL EGGLER Diverticulitis and sigmoiditis
 DEWITT STETTEN Carcinoma of the colon and its radical treatment
 HERBERT W MEYER Radical operations for carcinoma of the rectum
 JOHN C A GERSTER Conservative operations for carcinoma of the rectum
 Exhibition of moulages of pathological specimens of the gastro-intestinal tract

LINCOLN HOSPITAL

BRADLEY L COLEY—9 Management of bone tumors in a general hospital
 BENJAMIN SHERWIN—9 45 Complications in hernia operations
 PETER VOGEL—10 45 Management of a blood bank in a municipal hospital

MEMORIAL HOSPITAL

HAYES E MARTIN—9 Hemilaryngectomy for carcinoma
 GEORGE T PACK—9 Intrascapulothoracic amputation for melanoma
 Staff—10 Demonstration of x-ray and radium equipment
 Inspection of new Memorial Hospital

METROPOLITAN HOSPITAL

- J H FONES and L R KAUFMAN and staffs—9 Operations
 Staff—9 Dry clinics
 H D FURNISS and W P ECKES Discussion of intestinal obstruction
 JOHN S O HERRLIN Jr Water balance
 J H FONES and DR CHASE Breast
 J H FONES Discussion of ox fascia in the repair of hernias
 L R KAUFMAN W B JOHNSON, and A LESSER, Demonstrations of wire sutures in hernia with a report of experimental work on dogs
 J H FONES J CLIFFORD HAYNER and CHARLES I HALBERSTAM Report on the present status of appendicitis.
 J WALSH Report on the value of rebound tenderness

MORRISANIA CITY HOSPITAL

- GEORGE E. MILANI—2 Operation for repair of large hernias by fascial flaps
 WILLIAM KLEIN—3 30 Treatment of acute mesenteric lymphadenitis

NEW YORK CITY CANCER INSTITUTE (Welfare Island Hospital)

- IRA I KAPLAN and associates—2 Symposium on cancer
 IRA I KAPLAN Demonstration of cancer cases
 LIONEL S AUSTER Surgical problems of advanced cancer illustrated by specific cases
 DAVID E. EHRLICH Interesting roentgenograms of advanced cancer cases

NEW YORK CITY HOSPITAL

- ISIDORE KROSS and staff—9 Operative and dry clinics

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

- MARY L EDWARD, FRMA ARONSON and MARGARET STANLEY BROWN—9 Operations
 ASTA WITNER and SOPHIE SPITZ—9 Sterility clinic

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

- THOMAS H RUSSELL—9 Operations
 CARL EGGER—2 Operations Breast head and neck cases

JOHN F ERDMANN—2 30 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- HERBERT C. CHASE—11 Operations.
 WILLIAM M COOPER—2 30 Lecture and demonstration on varicose veins

PRESBYTERIAN HOSPITAL

- ALLEN O WHIPPLE and staff—9 Operations Pancreas
 Dry clinic and follow up pancreatic lesions.
 DANA W ATCHLEY JOHN SCUDDER and OCTA C LEIGH—2 Symposium on fluid loss and fluid balance in surgery
 F B ST JOHN, H D HARVEY C A FLOOD and ROSS GOLDEN—2 Symposium on gastric and duodenal lesions

ROOSEVELT HOSPITAL

- CONDUCT W CUTLER JR.—9 Gastric resection for carcinoma of the stomach
 ALFRED STILLMAN—9 Resection of the colon for carcinoma

SAINT FRANCIS HOSPITAL

- ROBERT B LOBBAN and staff—9 Operations for primary hyperthyroidism secondary hyperthyroidism and non-toxic thyroid

ST LUKE'S HOSPITAL

- HENRY H M LYLE JOHN DOUGLAS EDWARD J DONOVAN
 WILLIAM F MACPHEE MORRIS K SMITH and staff—9 Operative and dry clinics
 W H BARRY Treatment of endocervicitis by electrocoagulation
 F W SOLLEY Injection treatment of hydrocele
 H J SHELLY Injection treatment of varicose veins.
 P C MORTON Demonstration of rolling proctologic equipment table relation of solitary polyps to carcinoma of the colon
 G E BURFORD Problems in organization of a department of anesthesia

SAINT VINCENT'S HOSPITAL

- LOUIS F SAMAN—2 Symposium Surgical jaundice
 FRANCIS V TIMONEY—3 Effect of iodine on the thyroid gland as seen in stage thyroidectomies.
 ANTHONY ROTTINO—3 Pathological demonstrations.

OBSTETRICS AND GYNECOLOGY

Monday

BETH ISRAEL HOSPITAL (Jewish Maternity Hospital)

- SAMUEL J SCADRON and EDWIN G LANGROCK—2 Obstetrical operations Dry clinic Cesarean section demonstration of forceps delivery

HARLEM HOSPITAL

- HENRY C FALK, PETER M MURRAY and MERRY H LEVINE—1 30 Organization of gynecological service in the large city institution
 FREDERICK A KASSEBORN—3 Placenta praevia

LIVING IN HOSPITAL

- H J STANDER—2 Staff conference Heart disease complicating pregnancy dystocia in a patient with a contracted pelvis.

METROPOLITAN HOSPITAL

- HORACE AYERS and staff—1 30 Dry clinic Transplantation of ovaries motion pictures cardboard demonstration presentation of patient
 DONALD E BRACE and staff—1 30 Collection of placental blood for indirect transfusions motion pictures.
 L S LOUZEUX and staff—1 30 Obstetrical and gynecological problems.

MOUNT SINAI HOSPITAL

- SAMUEL H GEIST and staff—1 30 Operative clinic The treatment of prolapse cystocele and incontinence in three typical cases

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

- MONTIMER N HYAMS and staff—2 Dry clinic Uteral punctionography by fractional injections of lipiodol sterilized

tion of the female as an office procedure, conization of the uterine cervix

PRESBYTERIAN HOSPITAL* (Sloane Hospital for Women)

W W HERRICK, ALVIN J B TILLMAN, and JEAN CORWIN
—2 Symposium on the toxemias and other complications of pregnancy

RIVERSIDE HOSPITAL

NELSON B SACKETT—2 Gynecological complications in advanced pulmonary tuberculosis

WOMAN'S HOSPITAL

WILLIAM T KENNEDY—2 Complete abdominal hysterectomy for fibroids, operation for incontinence of urine, cystocele, rectocele, laceration of pelvic floor, demonstration of Kennedy technique and end results
RALPH L BARRETT—2 Electrocoagulation of cervix, two cases, demonstration of technique and end results

Tuesday

BELLEVUE HOSPITAL

E W HOLLADAY—9 Operations Repair of old third-degree laceration
W E STUDDIFORD—9 Operations Repair of cystocele and rectocele, suspension of uterus
CLAUDE HEATON—9 Obstetrical ward rounds, complications of pregnancy, x-ray pelvimetry
H C TAYLOR, JR—2 Care of patients suffering from gynecological malignancy
W E STUDDIFORD and H C TAYLOR, JR—3 30 Demonstration of pathological material

BETH ISRAEL HOSPITAL

Staff—9 Gynecological dry clinic
HERMAN LORBER Carcinoma of fallopian tubes, carcinoma of ovary with peritoneal implants, five years after operation, early carcinoma of uterus
MAURICE RASHBAUM The diagnosis and management of urinary incontinence
SEYMOUR WIMPFHEIMER Chorioepithelioma
E A HOROWITZ The treatment of gonorrhea in women by systemic hyperpyrexia and simultaneous pelvic heating—an evaluation of 7½ years' experience Rationale of treatment, indications, technique, apparatus required, results in lower genital tract infections, in salpingitis and in gonorrheal arthritis, late results, treatment of gonorrhea in women by sulfanilamide, fever therapy combined with pelvic heating, treatment of a female patient with gonorrhea
MORTON VESSEL Dysgerminoma of ovary, granulosa cell tumor of ovary
HERMAN LORBER and staff—2 Operations Manchester operation for prolapse, vaginal hysterectomy, operation for incontinence

FLOWER-FIFTH AVENUE HOSPITAL

HORACE AYRES and staff—2 Transplantation of ovaries, cardboard demonstration, motion pictures and presentation of patient
DONALD BRACE—2 Collection of placental blood for indirect transfusions, motion pictures
L S LOIZEAUX and staff—2 Advances in prenatal and postpartum care
JOHN E TRITSCH and staff—2 Demonstration of apparatus for collection and mensuration of postpartum blood Results obtained from the use of several oxytocics on postpartum bleeding

FRENCH HOSPITAL

FREDEPICK C HOLDEN and staff—9 Pre-operative preparation of gynecological cases, nonoperative demonstration of LaForte operation for prolapse in elderly woman, Kennedy hysterectomy through vagina—nonoperative, discussion of extensive myomectomy with preservation of uterus in young woman, presacral resection of nerves for dysmenorrhea, bladder injuries in gynecological operations, postoperative care of gynecological patients
F C HOLDEN, H C FALK, H C WILLIAMSON and staff—9 Gynecological and obstetrical operations, inspection of the new obstetrical hospital

HARLEM HOSPITAL

HENRY C FALK, PETER M MURRAY, and MURRY H LEVINE—9 Operations, lecture on the tubal resection, a new and simple procedure for recurrent gonorrheal salpingitis
JULIUS KURZROCK—3 Demonstration of forceps operation with special reference to the axis traction

HOSPITAL FOR JOINT DISEASES

ABRAHAM RONGY and staff—2 Interposition and other gynecological operations
HOWARD E LINDEMAN and staff—2 The Manchester and other gynecological operations

LENOX HILL HOSPITAL

PERCY H WILLIAMS, ROBERT L MCCREADY and staffs—9 Operations

LYING-IN HOSPITAL

B H GOFF—9 Modified LaForte operation for complete prolapse, operation for uterine prolapse
Staff—2 30 Symposium on urinary tract infection of pregnancy
H J STANDER Relation of pyelitis to the toxemias of pregnancy
C M McLANE Follow-up study of pyelitis of pregnancy
H F TRAUT Pyelonephritis as a complication of pyelitis of pregnancy
R C BENSON Postpartum and postoperative bladder retention and its treatment
R G DOUGLAS Mandelic acid and sulphanilamide therapy in the treatment of pyelitis complicating pregnancy
A A MARCHETTI The pyelitis ileus syndrome.

MEMORIAL HOSPITAL

WILLIAM P HEALY—9 Gynecological operations

MOUNT SINAI HOSPITAL

SAMUEL H GEIST and staff—9 Ward rounds and dry clinic, ovarian tumors, pathological and clinical discussion with demonstration of specimens, management of uterine bleeding
ROBERT T FRANK, MORRIS A GOLDBERGER, and PAUL KLEMPERER—2 Exhibit of endocrine methods of diagnosis and hormone studies of cases

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

GERARD L MOENCH—10 Influence of abnormalities of spermatozoa on sterility
WALTER T DANNREUTHER—2 Operations Supravaginal hysterectomy for uterine fibroids, LeForte operation for complete prolapse, plication of the rectum and perineorrhaphy for enterocele, tracheloplasty for chronic endocervicitis

NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL

MALCOLM CAMPBELL—9 Gynecological operations

PRESBYTERIAN HOSPITAL
(Sloane Hospital for Women)B P WATSON and staff—9 Operations Plastic for cystocele and rectocele complete hysterectomy for cancer
J A CORSCADEN—2 Cancer symposium
L S COLER and J H BOYD—3 30 Demonstration of pathological material

ROOSEVELT HOSPITAL

H C TAYLOR T C PEIGHTAL H C TAYLOR Jr and W E ALSOP—9 Operations myomectomy radium or hysterectomy for fibroids radium or hysterectomy for postmenopausal bleeding

SYDENHAM HOSPITAL

JULIUS JARCHO—9 Operations
ALFRED M HELLMAN—10 30 Operations Hysterectomy for fibroids and diseased adnexa cesarean section (low flap)
JULIUS JARCHO—2 Roentgenography as an aid in obstetrical diagnosis

WOMAN'S HOSPITAL

EDWARD A BELLARD—9 Operation for complete laceration of sphincter ani (silver wire) Sturmdorf operation for chronic endocervicitis and end results
GEORGE G BEMIS—9 Laparotomy for fibroids

Thursday

BELLEVUE HOSPITAL

Staff—9 Dry Clinics
ARTHUR REICH Value of ergotrate in reducing incidence of postpartum hemorrhage
SPENCER GURNEE Sulfanilamide therapy in gonorrheal infections of female
F W SOVAK Operations for the relief of organic sterility in female demonstration of successful cases
W E STODDIFORD Treatment of incomplete abortion complicated by fever
M GOLDBLATT and L LANGMAN Analysis of 347 cases operated upon for ectopic pregnancy
IRA I KAPLAN—2 Operation Application of radium for carcinoma of cervix
F W SOVAK—2 Operation Reconstruction of fallopian tubes
D BARROWS—2 Operation Supravaginal hysterectomy for fibromyomata uteri

FLOWER FIFTH AVENUE HOSPITAL

H B SAFFORD and staff—9 Gynecological and obstetrical surgery

HARLEM HOSPITAL

HENRY C FALK PETER M MURRAY and MURRY H LEVINE—9 Classification and management of the infected abortion operations
A CHARLES POSNER—3 Breech presentation Methods employed to reduce foetal and neonatal mortality

LINCOLN HOSPITAL

EDWARD J DAVIN and staff—9 Use of intravenous ergonovine at the end of the second stage of labor results in over 500 cases

HAROLD C INGRAM—2 Treatment of pelvic inflammatory disease by various modalities
ROBERT L CRAIG—2 Treatment of pelvic inflammatory disease by acetyl beta methyl choline
FRANK SPIELMAN—3 Gynecological pathology some unusual ovarian neoplasms

LUTHERAN HOSPITAL

JAMES T PADGETT—9 Operations

LYING-IN HOSPITAL

H J STANDER—9 Operation for cure of cystocele and rectocele
H F TRACT—9 Myomectomy and hysterectomy
H J STANDER—2 30 A study of acute yellow atrophy
H F TRACT—3 The clinical and histological differentiation between hypertrophy and hyperplasia of the endometrium
J B PASTORE—3 30 Anemia in pregnancy
R G DOUGLAS—4 Intrapartum infection and its relation to the time of cesarean section

METROPOLITAN HOSPITAL

L S LOIZEAUX—9 Operations

MISERICORDIA HOSPITAL

JAMES P HENNESSY—9 30 Modified Scanzoni for occiput posterior
F WALTER GRAVELLE—10 Forceps technique single application for occiput posterior
ALEXANDER H SCHMITT—10 30 Complications requiring cesarean section
FREDERICK E NEEF—2 Application of radon ring in carcinoma of the uterine cervix
JOSEPH A DEVLIN—3 Operative indications in gynecological emergencies
FRANCIS W SOVAK—4 Operative treatment for sterility lantern slides

MOUNT SINAI HOSPITAL

ISIDOR C RUBIN—9 30 Ward rounds and demonstration of cases Genital tuberculosis kidney tumors myomectomy vaginal supravaginal hysterectomy and parametrial fixation for prolapse and myoma
ISIDOR C RUBIN and staff—2 Operations Parametrial fixation (Donald Fothergill) for prolapse of uterus local analgesia multiple myomectomy (show hippuran) laparotomy for salpingolysis plastic for cystorectocle parasacral anesthesia motion picture of parametrial fixation.NEW YORK INFIRMARY FOR WOMEN
AND CHILDREN

WILHELMINA RAGLAND and associates—9 Tokemias of pregnancy x ray pelvimetry care of prematures

NEW YORK POST GRADUATE MEDICAL SCHOOL
AND HOSPITALTHEODORE NELSTAEDETER and staff—10 Clinical use of estrogenic hormones
ADOLPH JACOB and staff—2 Treatment of pelvic exudates with iontophoresisNEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL

LOUIS J LADIN—9 Operations

PRESBYTERIAN HOSPITAL (Sloane Hospital for Women)

B P WATSON and staff—9 Cesarean sections, obstetrical rounds, cardiac, toxemias and other complications
W E CALDWELL, HOWARD C MOLOV, and D ANTHONY D'ESOP—2 Diagnosis of pelvic abnormality, x-ray pelvimetry, the precision stereoscope in the mechanism of labor

ROOSEVELT HOSPITAL

H C TAYLOR, T C PEIGHTAL, H C TAYLOR, JR, and W E ALSOP—9 Operations Kennedy operation for bladder incontinence operation for cystocele and rectocele, tubal implantation of occluded tubes
T C PEIGHTAL, H C TAYLOR, JR, W E ALSOP, and A V GREELEY—2 Dry clinic Pelvic cancer, postmenopausal bleeding, endometriosis, tubal implantation cases, demonstration of ovarian tumors

SAINT FRANCIS' HOSPITAL

CHARLES VEJVODA and staff—9 Subtotal hysterectomy, total hysterectomy, salpingectomy, uterine suspension

SYDENHAM HOSPITAL

JULIUS JARCHO—9 Operations
ALFRED M HELLMAN—2 Dry clinic Large mesenteric tumor, cornual pregnancy, Kennedy hysterectomy, presentation of patients and specimens; skiodan salpingography

WOMAN'S HOSPITAL

RALPH A HURD—9 Cesarean section, low flap
ALBERT H ALDRIDGE—9 Cesarean section, Latzko, demonstration of modified technique and end results, with lantern slides, vaginal hysterectomy for uterine prolapse, Bissell technique
DR CARY—9 Treatment of sterility, demonstration of spermatozoa, moving pictures
NELSON B SACKETT—2 Abdominal hysterectomy for carcinoma of corpus uteri, postradiation
GEORGE GRAY WARD—2 Insertion of radium for carcinoma of cervix, end results of treatment of gynecological cancer, demonstration of treated cases
HARRIET MCINTOSH—2 X-ray therapy for gynecological cancer

Friday

BELLEVUE HOSPITAL

E W HOLLADAY—9 Operation Repair of cystocele and rectocele
H C TAYLOR, JR—9 Laparotomy for ovarian cyst, complete hysterectomy for carcinoma of corpus uteri
I WELLEN—9 Obstetrical ward rounds, toxemias of pregnancy
A REICH—9 Demonstration of Barton forceps

FLOWER-FIFTH AVENUE HOSPITAL

HORACE AYERS and staff—9 Operations

HARLEM HOSPITAL

FREDERICK A KASSELBOHN, JULIUS KURZROCK, and A CHARLES POSNER—3 Emergency operative clinic

LENOX HILL HOSPITAL

ROBERT L MCCREADY, PERCY H WILLIAMS and staffs—9 Operations

LINCOLN HOSPITAL

JOHN A KELLEY—9 Treatment of carcinoma of cervix and corpus uteri

LUTHERAN HOSPITAL

FREDERICK A KASSEBOHM—9 Emergency obstetrical procedures

LYING-IN HOSPITAL

H F TRAUT and R G DOUGLAS—9 Demonstration of the organization and operation of a cancer follow-up clinic

METROPOLITAN HOSPITAL

H B SAFFORD and staff—9 Operations

MOUNT SINAI HOSPITAL

ISIDOR C RUBIN and staff—9 30 Sterility clinic Mechanical aspects of tubal insufflation, motion pictures, endocrine aspects in outpatient department
SAMUEL H GEIST and staff—2 Some aspects of gynecological urology

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

THOMAS H CHERRY—9 Operations Anterior colporrhaphy and perineorrhaphy, vaginal hysterectomy for uterine fibroids, plastic repair of fallopian tubes for sterility, tracheloplasty for chronic endocervicitis
WALTER T DANNREUTHER—10 Diagnosis of ectopic pregnancy, lantern slide demonstration
WALTER T DANNREUTHER—2 Operations Radium application for carcinoma of the cervix, oophorectomy for ovarian tumor, interposition operation for complete prolapse, supravaginal hysterectomy for uterine fibroids
I W KAHN and staff—3 Important urological conditions in gynecological patients

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID N BARROWS—9 Gynecological operations
EDWARD H DENNEN—10 Obstetrical problems, lecture

PRESBYTERIAN HOSPITAL (Sloane Hospital for Women)

B P WATSON and staff—9 Operations, obstetrical rounds, obstetrical analgesia and anesthesia
RAPHAEL KURZROCK and associates—2 Symposium on endocrine disturbances

ROOSEVELT HOSPITAL

H C TAYLOR, T C PEIGHTAL, H C TAYLOR, JR, and W E ALSOP—9 Fothergill operation for uterine prolapse, operation for endometriosis, operation for chronic adnexal disease

SAINT FRANCIS' HOSPITAL

ALEXANDER NICOLL and staff—9 Hysterectomy, total hysterectomy, subtotal salpingectomy and suspension

SAINT VINCENT'S HOSPITAL

WILLIAM M FORD, WALLACE KRUGLER, JOHN F McGRATH, JAMES P HENNESSY, and JOSEPH E CORR—9 Operations

SYDENHAM HOSPITAL

JULIUS JARCHO—2 Dry clinic Uterosalingography—visualization of the internal genitalia by means of injection of contrast media

WOMAN'S HOSPITAL

EDWARD A BULLARD—9 Operation for cystocele, rectocele, laceration of pelvic floor
ALBERT H ALLDRIDGE—9 End results of spontaneous versus prophylactic methods of delivery, with lantern slides

JOHN W. DAVIES—9 Operation for incontinence of urine cystocele rectocele laceration of pelvic floor
 HARRIET MCINTOSH—9 X-ray pelvimetry Caldwell Mcloy technique
 ARTHUR J. MURPHY—2 Operation for fibroids

GEORGE G. WARD—2 Vaginal hysterectomy for uterine prolapse Mayo technique
 DR. WHITE—2 Diagnosis and treatment of intestinal obstruction in gynecological cases

GENITO URINARY SURGERY

Monday

HOSPITAL FOR JOINT DISEASES

PAUL W. ASCHNER IRVING SIMONS J. SIDNEY RITTER and WILLIAM BISHER—2 Operations Nephrectomy for tuberculosis aseptic technique pyelonephrolithotomy pelvic ureterolithotomy Dry clinics Evaluation of excretion urography cystometry and sphincterometry in diagnosis seminal vesicles diagnosis and therapy selection of procedures in prostatic hypertrophy

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DANIEL A. SINCLAIR—3 30 Operations

SIDENHAM HOSPITAL

RALPH L. DOORMASKER—2 Lesions in the female urethra relationship of bone fractures to formation of calculi in the urinary tract treatment of urethral calculi with rubber bags and metallic dilators

Tuesday

FLOWER FIFTH AVENUE HOSPITAL

S. CARLETON and staff—9 Kidney and prostate surgery demonstration of clinic apparatus models and sketches

MEMORIAL HOSPITAL

BEE JAMIE BARRINGER—10 Suprapubic cystostomy for carcinoma

METROPOLITAN HOSPITAL

S. CARLETON and staff—1 30 Operations

MORRISANIA CITY HOSPITAL

TERRY M. TOWNSEND—1 30 Operation Prostatic obstruction

JOHN DEFF—2 Dry clinic Urological malignancies

JOHN J. ROTH—2 30 Diverticulae of the bladder

NEW YORK CITY HOSPITAL

THOMAS J. FERRIN—2 Operative and dry clinics

NEW YORK HOSPITAL

A. RAYMOND STEVENS OSWALD TOWSLEY and staffs—2 Operative and dry clinics

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE KUMNER—9 Dry clinic

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

JOSEPH A. HYAMS—2 Operative and dry clinics

PRESBYTERIAN HOSPITAL

J. BENTLEY SQUIER and staff—2 Operations

RIVERSIDE HOSPITAL

SIMON A. BEISLER—3 Urogenital conditions in the tuberculous

UNITED STATES MARINE HOSPITAL

C. FRETSON and R. A. MEE—2 Symposium on prostatic surgery

WOMAN'S HOSPITAL

HENRY G. BIGBEE—2 Nephrectomy for pyonephrosis genito-urinary problems in relation to gynecology and obstetrics

ALBERT H. ALDRIDGE—2 Treatment of postoperative vesicovaginal fistula demonstration of new technique lantern slides

Thursday

BEILEVUE HOSPITAL

ALEXANDER R. STEVENS and staff—9 30 Symposium on urinary calculus

ALEXANDER R. STEVENS and staff—2 Operations

BETH ISRAEL HOSPITAL

Staff—2 30 Operative and dry clinics

ABRAHAM HYAM Differential diagnosis of renal and suprarenal tumors with lantern slides

SEYMOUR F. WILHELM Diagnosis and operative treatment of male sterility with lantern slides Presentation of cases of unusual interest

FLOWER FIFTH AVENUE HOSPITAL

S. CARLETON and staff—9 Kidney and prostate surgery demonstration of clinical apparatus models and sketches

FRENCH HOSPITAL

CHARLES H. CHETWOOD and JOHN DENNIS GOONEY—9 Treatment of lacerated kidney and ureter demonstration of case lacerations of bladder lacerations of urethra injuries to testes

LINCOLN HOSPITAL

DAVID CEIRINGER FRANCIS I. TAYLOR FOR E. CAMPBELL and ISIDOR PALAIS—9 Operations

NEW YORK CITY HOSPITAL

JOHN H. MORRISSEY—2 Perineal surgery

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE KUMNER—9 Dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

JOSEPH F. MCCARTHY—3 30 Operations

PRESBYTERIAN HOSPITAL

J. BENTLEY SQUIER and staff—2 Symposium on tumors of the kidney

ROOSEVELT HOSPITAL

SIMON A. BEISLER—2 Transurethral prostatectomy suprapubic prostatectomy nephrectomy

ST LUKE'S HOSPITAL

Staff—10 30 Dry clinic
 HENRY H M LYLE Ombredanne operation for hypospadias
 H G BUGBEE Neoplasms of the urinary tract
 G F HOCH Urinary calculi
 J A TAYLOR Transurethral resection
 A J MURPHY Urologic complications following hysterectomy

Friday

FLOWER-FIFTH AVENUE HOSPITAL

S CARLETON and staff—9 Kidney and prostate surgery, demonstrations of clinical apparatus, models and sketches

LENOX HILL HOSPITAL

Staff—9 Symposium on affections of the urinary tract and their treatment
 GEORGE W SLAUGHTER Use of sulphanilamide in urological infections
 HERBERT W MEYER Case presentations Conservative surgery of strictures of the uretero-pelvic junction, repair of hypospadias—late result
 WILLIAM R DELZELL Perirenal air insufflation as an aid in diagnosis, moving pictures
 PETER A NARATH The role of the hydromechanics in the renal pelvis in general body infections
 HERBERT R KENYON The present status of transurethral prostatic resection
 MAXIMILIAN M NEMSER Presentation of interesting cases of renal tumors

LUTHERAN HOSPITAL

TERRY M TOWNSEND—2 Operations Surgery of hypertrophied prostate

METROPOLITAN HOSPITAL

S CARLETON and staff—1 30 Operations

MISERICORDIA HOSPITAL

MAXIMILIAN NEMSER and HUBERT LYONS—9 30 Symposium on tumors of the urinary tract HUBERT LYONS Diagnosis of renal, ureteral and vesical tumors MAXIMILIAN NEMSER Management of tumors of the urinary tract, pyelographic changes in various types of renal tumors, lantern slides
 ROBERT C SCHLEUSSNER—11 Pathologic classification of tumors of the urinary tract, demonstration of gross microscopic specimens

MOUNT SINAI HOSPITAL

GORDON D OPPENHEIMER and MOSES SWICK—1 15 Operative and dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID GEIRINGER—3 30 Operations

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIR and staff—2 Operations

SAINT VINCENT'S HOSPITAL

HERBERT MOHAN, WENDELL J WASHBURN, THOMAS F HOWLEY, E CRAIG COATS, and GAETANO J MECCA—9 Operations

SYDENHAM HOSPITAL

SAMUEL LUBASH—9 Operations Plastic repair of the kidney pelvis in hydronephrosis
 SAMUEL MALISOFF—10 30 Operations Transurethral resections for vesical neck obstructions
 LOUIS FRIEDMAN—1 Operations

SURGERY OF THE BONES AND JOINTS

Monday

BELLEVUE HOSPITAL

ARTHUR KRIDA—2 Operations

HOSPITAL FOR JOINT DISEASES

HARRY FINKELSTEIN and staff—2 Dry clinic Cases of leg lengthening, rachitic deformities treated by decalcification method, stenosing tendovaginitis, epiphyseolysis of the hip, synostosis operation for ununited fractures of the tibia and fibula, cases of hallux valgus (new operation), cases of subtrochanteric osteotomy by the inverted "L" procedure, low back lesions, venography for muscle angiomas, glomus tumors

METROPOLITAN HOSPITAL

A H BINGHAM and staff—1 30 Operative and dry clinics

MISERICORDIA HOSPITAL

GASTON A CARLUCCI—2 Osteomyelitis—the surgical problem

NEW YORK ORTHOPAEDIC HOSPITAL

HALFORD HALLOCK—1 30 General clinic, including all orthopaedic conditions

Tuesday

HOSPITAL FOR JOINT DISEASES

LEO MAYER and staff—0 Dry clinic
 LEO MAYER Cases illustrating reconstructive tendon surgery
 NICHOLAS S RANSOHOFF Abdominal fascial transplants for abdominal paralysis
 BENJAMIN WOLFORT Adamantinoma of the tibia
 JOSEPH MILGRAM The aspiration therapy of subacromial bursitis
 DAVID TELSON Fractures of the neck of the femur treated by wiring
 HARRY D SONNENSCHN and staff—2 Dry clinic
 HARRY D SONNENSCHN Two cases of resection of the elbow joint, lipoid granulomatosis of ribs and sacrum
 MICHAEL S BURMAN Complete condylar fracture of the humerus in an adult, operative removal of displaced condyles, tourniquet paralysis of lower extremity following knee operation, operative release of sciatic nerve, two cases of fracture of posterior arch of atlas
 JOSEPH G WISNER Two cases of congenital dislocation of hips diagnosed soon after birth, subcutaneous drilling for the relief of pain in osteo-arthritis of the hip after old slipped epiphysis of the upper femoral epiphysis

MARK YOUNG'S Three cases of giant cell tumor of the spine

ABRAHAM KENIN Case of coliosis treated by wedged turnbuckle jacket and two stage spine fusion operation case of Scheuermann's disease of the spine case of narrowed intervertebral disc between L₅ and S₁

SAUL RITCHIE A complicated wrist fracture—communion Colles fracture fracture of the scaphoid and fracture with displacement of the os magnum operation removal of displaced head fracture of the neck of the femur in a child slipped upper femoral epiphysis fracture of the neck of the femur in reduction and result

LOUIS SALTZMAN Operative removal of free bodies in peroneal tendon sheath

ADOLPH SCHMIDT Fracture dislocation of the elbow—2 cases—one with median nerve involvement and one with ulnar nerve involvement

ISADORE ZUCKER and staff—1 Operations Horizontal wedge arthrodesis for flat foot

HOSPITAL FOR RUPTURED AND CRIPPLED

PHILIP D. WILSON and EARL E. VAN DERWERKER—9 Ward rounds children's orthopedic service

Staff—10 End result clinic

Staff—10 30 Regular weekly orthopedic staff meeting with service reports from house surgeon.

RAYMOND W. LEWIS X-ray reports.

DOMINIC A. DESANTO Interesting pathological specimens

BRADLEY L. COLBY NORMAN L. HIGHBYNTHAM and DOMINIC A. DESANTO—2 Discussion of problems in diagnosis and treatment of bone tumors

MONTEFIORE HOSPITAL

SETH SELIG—10 Dry clinic Diagnosis and treatment of unsuspected adrenal insufficiency in bone tuberculosis

ROBERT A. LIPPMAN—10 Dry clinic Bone tuberculosis

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on scoliosis

ALAN DEL SMITH Routine treatment organization of special clinic criteria for selection of patients for operation compensation.

ALBERT B. FERGUSON Measurement of the curve identification of primary curve determination of area for operation

MCDOWELL ANDERSON The jacket principles application and preparation for operation semi bent and straight jacket

BENJAMIN P. FARRELL Spine fusion operation technique

ALAN DEL SMITH Results of operative treatment
GEORGE L. INCE—1 30 Scoliosis clinic Demonstration of cases before and after operation

ST. LUKE'S HOSPITAL

MATTHEW CLEVELAND and D. M. BOSWORTH—2 Operative and dry clinics Tibial distraction treatment of fracture of the neck of the femur

Thursday

BELLEVUE HOSPITAL

ARTHUR KRIDA and staff—2 Symposium on orthopedic surgery Intracapsular fracture of neck of the femur bone peg operation epiphyseal fracture of the neck of the femur bone peg operation congenital dislocation of the

hip genu recurvatum operation cruciate ligament repair encircling fascial band operation for spay foot and hallux valgus congenital absence of tibia Charcot's knees fusion operation modified reconstruction of the hip for osteo-arthritis

FLOWER FIFTH AVENUE HOSPITAL

A. H. BINGHAM and staff—9 Problems in orthopedic surgery demonstration of cases illustrated by motion pictures and lantern slides

GOVERNOR HOSPITAL

WALTER LUDLUM and staff—2 Presentation of cases from orthopedic and traumatic services Fractures of the neck of the femur conservative treatment—3 cases lumbar puncture injury of intervertebral disc slipped capital femoral epiphysis open reduction 2 cases fracture of shaft of humerus traction suspension treatment operations for weak feet head injuries with visual disturbances—2 cases head injuries new aspects of management Russell traction fractured femurs in children

HOSPITAL FOR JOINT DISEASES

SAMUEL A. JARVIS and staff—9 Operations.

HARRY FINKELSTEIN and staff—9 Operations Lengthening stenosing tendovaginitis correction of rachitic deformities new operation for hallux valgus reduction of epiphyseolysis of the hip

SAMUEL A. JARVIS and staff—2 Dry clinic

MOUNT SINAI HOSPITAL

Staff—9 Operative and dry clinics.

SETH SELIG Fixation of osteo-arthritis of the hip joint by Smith Petersen nail

ROBERT LIPPMAN Internal fixation of intra-capsular fracture of the neck of the femur by the cortex-ten bolt.

FORREST M. BICK Immediate results in pathological fracture

ALBERT J. SCHMIDT End results of hemiphysalngectomy for hallux valgus

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on tuberculosis of joints.

WALKER E. SWIFT Pathology and diagnosis

ALAN DEL SMITH Treatments general consideration and reasons for operative treatment

Demonstration of patients illustrating end results

WILLIAM H. VON LAKEM Spine

HALFORD HALLOCK Hip elbow

GEORGE L. INCE Knee

LEONIDAS A. LANTZOUNIS Ankle

M. BELKETT HOWORTH Shoulder

FREDERICK L. LIEBOWITZ Wrist

GEORGE L. INCE—1 30 Outpatient clinic general orthopedic conditions

MALCOLM B. COUPTS—1 30 Club feet

RIVERSIDE HOSPITAL

HENRY MILNER—10 Bone complications in advanced pulmonary tuberculosis

HOSPITAL FOR RUPTURED AND CRIPPLED

Staff—2 Presentation of orthopedic problems

RUFUS H. ALLORDE Localized osteitis fibrosa cystica

RICHMOND STEIGER Operative treatment of flat feet

JOHN R. COBB Scoliosis

ERNEST F. MYERS Low back pain

T. CAMPBELL THOMPSON Epiphyseolysis

PHILIP D. WILSON Elbow fractures carpal injuries

LEWIS C WAGNER Tendon transplantation for paralytic wrist drop
 FRANCIS CARR Fractures of the lower end of the femur
 T CAMPBELL THOMPSON Presentation of cases for operation Friday morning

UNITED STATES MARINE HOSPITAL

W. G. DORAN—2 Operations

VETERANS ADMINISTRATION HOSPITAL

T F CARROLL—12 45 Demonstrations Artificial limb assembly, modified and improved braces, fabricated jackets and supports, orthopedic shoes
 CHARLES F BLOOM—12 45 Roentgenological equipment, presentation of x-ray material, films and lantern slides of current cases and others of particular interest to the general surgeon and cancer specialist
 C R BROOKE—12 45 Physical therapy department, newer modalities of particular interest to the surgeon

Friday

GOUVERNEUR HOSPITAL

WALTER LUDLUM and staff—9 Presentation of cases from orthopedic and traumatic service Fractured femur with sciatic nerve injury, fractures of the jaw, selective neurectomy, fracture of humeral condyles, 6 months after open correction—2 cases, fixation of oblique fractures of long bones by Kirschner wire, ambulatory spreaders, incidence of open correction in fresh fractures, fractures of tibial plateau, club feet treated by conservative methods

HOSPITAL FOR JOINT DISEASES

SAMUEL KLEINBERG, JOSEPH BUCHMAN and staff—9 Dry clinics
 SAMUEL KLEINBERG Cases of chronic slipped femoral epiphysis treated by open operation, cases of arthroplasty of the hip and knee
 JOSEPH BUCHMAN Cases of chronic osteomyelitis under maggot treatment, case of Perthes' disease complicating rickets
 JOSEPH BUCHMAN and HERMAN LIEBERMAN Cases of syphilis of bones and joints

FRACTURES AND TRAUMATIC SURGERY

Monday

HARLEM HOSPITAL

LOUIS T WRIGHT, RALPH H YOUNG, DAVID H SMITH, CALDWELL B ESSELSTYN, JESSE J GREENE, ARTHUR A ZINGARO, MAURICE C O'SHEA, FRANCIS L MORHARD, and THOMAS C CASE—3 15 Fracture symposium

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R MURRAY and staff—2 Dry clinic

Tuesday

BEEKMAN HOSPITAL

Staff—9 Ward rounds and dry clinics
 ROBERT H KENNEDY Fracture of shaft of the femur
 JAMES H HEYL Fractures of the elbow
 SIGMUND MAGE Compound fractures
 LESTER BLUM Fractures of the shaft of the humerus

M HERZMARK Case of periosteal fibrosarcoma of the lower end of the femur, six years postoperative, no recurrence, no amputation
 HERMAN LIEBERMAN Cases of club feet treated by manual correction
 R R GOLDENBERG Case of Perthes' disease complicating a dislocation of the hip
 F I SCHWARZBERG Cases of osteochondritis of the ischiopubic region
 SAMUEL KLEINBERG, JOSEPH BUCHMAN and staff—9 Operations Arthroplasty, slipped femoral epiphysis, Perthes' disease, osteomyelitis
 LEO MAYER and staff—2 Operations Reconstructive tendon surgery

LINCOLN HOSPITAL

ARMITAGE WHITMAN—9 Operative and dry clinic

NEW YORK ORTHOPAEDIC HOSPITAL

BENJAMIN P FARRELL and staff—9 Operations
 BENJAMIN P FARRELL—1 30 Outpatient clinic, general orthopedic conditions

HOSPITAL FOR RUPTURED AND CRIPPLED

PHILIP D WILSON and staff—9 Operations
 Staff—11 Presentation of orthopedic problems
 LEWIS C WAGNER High osteotomy for lesions of the hip
 PHILIP D WILSON Slipped femoral epiphysis
 T CAMPBELL THOMPSON Stabilization of equinus foot
 RAYMOND W LEWIS and WALTER GRAHAM Secondary osteo-arthritis following fractures of the ankle.
 LEWIS CLARK WAGNER Plastic operation for recurrent dislocation of the patella
 JOHN R COBB Fractures of surgical neck of the humerus
 KRISTIAN D HANSSON Paralysis of the serratus magnus

SYDENHAM HOSPITAL

HARRY D SONNENSCHN, JOSEPH G WISNER, MARK M YOUMANS, and ADOLPH A SCHMIER—9 Dry clinic
 Fractures of shoulder, wrist and elbow

ROBERT T FINDLAY Conservative treatment versus immediate amputation in severe injuries of the hand and forearm
 THOMAS M LOWRY Fractures of the scapoid
 MYRON A SALLICK Russell traction

BELLEVUE HOSPITAL

J GORDON LEE, HERBERT M BERGAMINI, ROBERT WADHAMS, KENNETH M LEWIS, and GEORGE KOENIG—12 30 Symposium on fractures, return clinic, ward rounds following clinic

FLOWER-FIFTH AVENUE HOSPITAL

M J WILSON and staff—9 Demonstration of Russell traction and other fracture problems

MISERICORDIA HOSPITAL

SAMUEL B BURK—9 30 Operative and dry clinics
 FRANCIS X TIMONEY—11 Diagnosis and treatment of fractures

MARK YOUNG Three cases of giant cell tumor of the spine

ABRAHAM KENTY Case of scoliosis treated by wedged turnbuckle jacket and two-stage spine fusion operation case of Scheuermann's disease of the spine case of narrowed intervertebral disc between L5 and S1

SAUL RITCHIE A complicated wrist fracture—commuted Colles fracture fracture of the scaphoid and fracture with displacement of the os magnum operative removal of displaced head fracture of the neck of the femur in a child slipped upper femoral epiphysis fracture of the neck of the femur in reduction and end result

LOUIS SALTZMAN Operative removal of free bodies in peroneal tendon sheath

ADOLPH SCHMER Fracture dislocation of the elbow—2 cases—one with median nerve involvement and one with ulnar nerve involvement

ISADORE ZADEK and staff—Operations Horizontal wedge arthrodesis for flat foot

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RAYMOND W. LEWIS X-ray reports

DOMINIC A. DE SANTO Interesting pathological specimens

BRADLEY L. COLEY **NORMAN L. HIGGINBOTHAM** and **DOMINIC A. DE SANTO**—2 Discussion of problems in diagnosis and treatment of bone tumors

MONTEFIORE HOSPITAL

SETH SELIG—10 Dry clinic Diagnosis and treatment of unsuspected adrenal insufficiency in bone tuberculosis

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ALAN DE F. SMITH Routine treatment organization of special clinic criteria for selection of patients for operation compensation

ALBERT B. FERGLSON Measurement of the curve identification of primary curve determination of area for operation

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BELLFVUE HOSPITAL

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HOSPITAL FOR JOINT DISEASES

SAMUEL A. JAHSS and staff—9 Operations

HARRY FINKELSTERN and staff—9 Operations Leg lengthening stenosing tendovaginitis correction of rickets deformities new operation for hallux valgus reduction of epiphyseolysis of the hip

SAMUEL A. JAHSS and staff—2 Dry clinic

MOUNT SINAI HOSPITAL

Staff—9 Operative and dry clinics

SETH SELIG Fixation of osteoarthritis of the hip joint by Smith Petersen nail

ROBERT LIPPMAN Internal fixation of intra-capsular fracture of the neck of the femur by the corkscrew bolt

EDGAR M. BICK Immediate results in pathological fractures

ALBERT J. SCHILIN End results of hemiphalangectomy for hallux valgus

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on tuberculosis of joints

WALKER E. SWIFT Pathology and diagnosis

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WILLIAM H. VON LACALM Spine

HALFORD HALLOCK Hip elbow

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FREDERICK L. LIEBOLT Wrist

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MALCOLM B. COULTS—1 30 Club feet

RIVERSIDE HOSPITAL

HENRY MILCH—10 Bone complications in advanced pulmonary tuberculosis

HOSPITAL FOR RUPTURED AND CRIPPLED

Staff—2 Presentation of orthopedic problems

REFUS H. ALLREDGE Localized osteitis fibrosa cystica

RICHMOND STEPHENS Operative treatment of flat feet

JOHN R. COBB Scoliosis

ERNEST E. MYERS Low back pain

T. CAMPBELL THOMPSON Epiphyseolysis

PHILIP D. WILSON Elbow fractures carpal injuries

NEUROSURGERY

Monday

NEUROLOGICAL INSTITUTE

BYRON STOOKEY—2 Operations for brain tumor

NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL

J E J KING—2 30 Operations

Tuesday

BELLEVUE HOSPITAL

JOSEPH E J KING—2 Operations

Staff—2 Symposium on neurological surgery

JOSEPH E J KING Demonstration of cases Brain
abscess, osteomyelitis of the skull, meningioma of the
middle fossaW D WINGEBACH Cases of brain and spinal cord
tumorsABRAHAM KAPLAN Operation for meningioma of the
brain, motion pictures, cases of extradural and sub-
dural hematomataFRANK TURNEY Case of subdural hygroma, ventricu-
lography and encephalography, Munro's tidal
drainage

NEUROLOGICAL INSTITUTE

CLARENCE HARE and GABRIEL SCHWARTZ—9 30 Car-
cinoma of the lung metastases to the brain

GEORGE HYSLOP—9 30 Thyroid metastases to the brain

BYRON STOOKEY—9 30 Neurosurgical measures for relief
of intractable pain due to metastatic carcinoma

PLASTIC AND FACIOMAXILLARY SURGERY

Tuesday

LINCOLN HOSPITAL

GUSTAV AUFRICHT and JACOB FRIEDMAN—2 Operative
and dry clinicsNEW YORK POST-GRADUATE MEDICAL SCHOOL
AND HOSPITAL

GUSTAV AUFRICHT and staff—9 Operative and dry clinics

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON, JR —9
Operations

SYDENHAM HOSPITAL

THEODOR BLUM—10 Ameloblastoma from the clinical
x-ray and pathologic standpoint with presentation of
cases

JACQUELINE W MALINIAC—1 30 Operations

Thursday

BETH ISRAEL HOSPITAL

ARTHUR BARSKY—9 Operations

LUTHERAN HOSPITAL

KEITH KAHN—2. Operations

Thursday

MONTEFIORE HOSPITAL

IRA COHEN—2 Operations

MOUNT SINAI HOSPITAL

IRA COHEN and A KAPLAN—9 Operations

NEUROLOGICAL INSTITUTE

FRITZ CRAMER—9 30 Relative occurrence of convulsive
seizures in depressed fractures of the skull—elevated and
non-elevatedKATE CONSTABLE—9 30 Relative occurrence of convul-
sive seizures following concussion without cranial frac-
tureJOHN E SCARFF—9 30 Cerebral scars in convulsive states
and their treatment

NEW YORK HOSPITAL

GEORGE J HEUER and staff—2 Dry clinics Surgery of
the nervous system

GEORGE J HEUER Surgery of the hypophysis

BRONSON S RAY Direct radiation of brain and spinal
cord tumors on the operating table

HAROLD G WOLFF Headache

JOSEPH C HINSEY Visceral pain

N CHANDLER FOOT Tumors of the peripheral nerves.

Friday

MOUNT SINAI HOSPITAL

IRA COHEN and A KAPLAN—9 Operations

NEUROLOGICAL INSTITUTE

CLEMENT MASSON—9 30 Tumors of the brain in children

BYRON STOOKEY—9 30 Tumors of the spinal cord in
children

NEW YORK CITY HOSPITAL

ALEXANDER ZIMANY—9 Operative and dry clinics

NEW YORK POST-GRADUATE MEDICAL SCHOOL
AND HOSPITAL

HAROLD S VAUGHAN and staff—11 Operations

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON, JR —9
Operations

SYDENHAM HOSPITAL

JACQUES W MALINIAC—3 Dry clinic

Friday

BELLEVUE HOSPITAL

YOLANDE HUBER—9 30 Operations

YOLANDE HUBER—2 Technique of dressings used for free
transplants, moulages, cases demonstrating Wolfie
grafts, cases of reconstruction for deformities following
burns of face, hands and feet, demonstrating use of
pedicled grafts, breast reconstructions, usual type, breast
reconstructions with free nipple transplants, rhinoplas-
ties and reconstructions for nasal defects, temporal muscle

NEW YORK CITY HOSPITAL

PRESTON WADE and BOARDMAN BOSWORTH—9 Operative and dry clinics

LYMAN W. CROSSMAN, DAVID SLOANE and CHARLES M. GRATZ—9 Intrapelvic protrusion of the acetabulum (Otto pelvis) tendon transplantation for wrist drop caused by posterior interosseous nerve paralysis following a compound fracture of the neck of the radius cases illustrating various fractures of knee joint traumatic dislocations neurotrophic joints

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R. MURRAY and staff—9 Operations

WILLIAM DARRACH, CLAY R. MURRAY and staff—3 Follow up clinic

SAINT VINCENT'S HOSPITAL

CONSTANTINE J. MACGUTHRIE JR.—2 Injuries of the carpal bones treatment

WILLIAM G. DORAN—Healing of fractures with acute hematogenous osteomyelitis immediate treatment of compound fractures institutional treatment of fractures treatment of compound dislocation of ankle joint

PRESTON A. WADE—2 Fractures of the neck of the femur comparison of results Whitman abduction method with internal fixation

Thursday

FRENCH HOSPITAL

SETH M. MILLIKEN, ROBERT P. WADSWORTH and Associates—9 Traction suspension treatment of fractures of the clavicle femur tibia and fibula skeletal traction versus skin traction in fractures demonstration of Kirschner wire and Steinman pin bilateral fracture of os calcis and fifth metatarsal treatment of fractured skulls fracture dislocation of cervical vertebra late reduction refracture of tibia and fibula 18 months after repair with sliding graft conservation of useful hand following traumatic avulsion of fingers and flexor tendons rupture of liver with recovery rupture of spleen with recovery x ray demonstration by Elmer M. Claiborne

KNICKERBOCKER HOSPITAL

GEORGE A. KOENIG, PHILIP D. ALLEN, RICHARD J. O'CONNELL, EDWARD R. FASTON, D. REES JENSEN and WADE DOOLEY—1 Fracture of the shaft of the humerus in the aged follow up of fracture of the neck of the femur treated by internal fixation supracondylar fracture of the humerus in children compound comminuted fracture of the tibia and fibula dislocation of the femoral head anterior dislocation of the cervical vertebra fracture of the lumbar vertebra divergent fracture dislocation of the metatarsal bones

LINCOLN HILL HOSPITAL

Staff—9 Fracture Clinic

WALTER I. CALLAND Ambulatory skeletal traction for overriding fractures of clavicle dislocations of the carpal semilunar bone (3 cases) reduction with the aid of the Thomas wrench

JOHN C. A. GERSTER Open reduction of fractures

ALFRED F. WISENTHAL Fractures of the spine

HENRY JORDAN After care of fractures with special reference to brace treatment

SIDNEY GAYNOR Ischial seat brace, Lorenz osteoclast for treatment of fractures a cabinet for storing plaster of Paris bandages

Inspection of hospital brace shop

LINCOLN HOSPITAL

KIRBY DWIGHT, EDWARD D. TRUESDELL, JAMES R. LINCOLN and JACOB FRIEDMAN—2 Symposium on fractures Ward rounds

METROPOLITAN HOSPITAL

M. J. WILSON and staff—1 30 Russell traction treatment of compound fractures

MORRISANIA CITY HOSPITAL

EUGENE J. BOZSAN—9 30 Obscure traumatism of the hip joint

THOMAS J. BRENNAN—9 30 Operations

THOMAS J. O'KANE and FREDERICK W. WILLIAMS Diabetic surgery of the extremities

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

HERBERT M. BERGAMINI and EMMETT A. DOOLEY—2 Operative and dry clinics Fractures of the neck of the femur (At Reconstruction Hospital)

JOHN J. MOORHEAD—2 Operations

H. H. RITTER—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID M. BOSWORTH—10 Operative and dry clinics

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R. MURRAY and staff—9 Operations

WILLIAM DARRACH, CLAY R. MURRAY and staff—2 Traction clinic

UNITED STATES MARINE HOSPITAL

E. C. STAMM and staff—10 30 Symposium on fractures of the jaw

F. LEBERSON and S. P. COOPER—2 Symposium Shoulder injuries x ray aspects and follow up clinics

Staff—2 Symposium on head injuries

H. KELMAN Neurological aspects

L. A. PALMER and staff Surgical aspects

Friday

BEKMAN HOSPITAL

Staff—9 Ward rounds and dry clinics

ROBERT H. KENNEDY Fracture of shaft of the femur

JAMES H. HEYL Fracture of the elbow

SIGMUND MAER Compound fractures

LESTER BLUM Fractures of the shaft of the humerus

ROBERT F. FINDLAY Conservative treatment versus immediate amputation in severe injuries of the hand and forearm

THOMAS M. LOWRY Fractures of the scapoid

MYRON A. SALLICK Russell traction

FLOWER FIFTH AVENUE HOSPITAL

M. J. WILSON and staff 9 Treatment of compound fractures demonstrations of end results

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R. MURRAY and staff—9 Fracture conference

GRANT THORBURN Indications for collapse therapy
 PHILIP G C BISHOP Pneumothorax
 HERBERT C MAIER Intrapleural pneumolysis
 WALTER T STENSON Possible pitfalls in phrenic nerve crushing
 HERBERT W MAYER Results of surgical treatment of pulmonary tuberculosis at Lenox Hill Hospital during the last twenty years
 OTTO C PICKHARDT Extrapleural thoracoplasty
 H McLEOD RIGGINS Tuberculous empyema—medical treatment
 CARL EGGERS Tuberculous Empyema—surgical treatment
 JOHN D KERNAN, GIRARD OBERRENDER and H McLEOD RIGGINS Tuberculosis of the bronchi
 WILLIAM H STEWART Cinefluorographic demonstration of respiration Breathing in normal cases, breathing in patients with pulmonary tuberculosis, breathing in patients after phrenic crushing, breathing in patients with pneumothorax, breathing in patients after extrapleural thoracoplasty

RIVERSIDE HOSPITAL

LOUIS CARP—9 Operations Phrenemphraxia, pneumolysis, thoracoplasty.

LOUIS CARP and staff—2 Dry clinics
 LOUIS CARP Cold abscess of chest wall, thoracoscopy and contra-indications for pneumolysis
 ARTHUR H AUFSES Indications for thoracoplasty
 JEROME M ZIEGLER The management of tuberculous empyema
 BORRIS A KORNBLITH Follow-up results in phrenemphraxia
 MAX TASCHMAN Demonstration of pneumothorax and its complications

ROOSEVELT HOSPITAL

FRANK B BERRY—9 Lobectomy and thoracoplasty

ST LUKE'S HOSPITAL

A E W ADA and associates—9 Operative and dry clinics
 P G C BISHOP Selective bronchography
 S T ALLISON Diseases of the mediastinum
 O R JONES Pneumothorax therapy for tuberculosis during pregnancy
 L C KNOX Pathology of primary carcinoma of the lung
 A E W ADA Surgical treatment of acute abscess of the lung

OTOLARYNGOLOGY

Monday

FLOWER-FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Operations and demonstrations of interesting cases Mastoid operations
 M S LLOYD—2 Bronchoscopic demonstrations
 Motion pictures and exhibits in Trustees' Room

HARLEM EYE AND EAR HOSPITAL

CHARLES B MEDING—9 Tonsil operation
 ALBERT HETHERINGTON and I HENRY ALEXANDER—2 Demonstrations of cases

LUTHERAN HOSPITAL

CHARLES C FRANCIS and staff—2 Operations

MANHATTAN EYE, EAR AND THROAT HOSPITAL

JAMES G DWYER, C M GRIFFITH and staff—2 Otological operations
 DAVID H JONES and O L MONROE and staff—2 Rhinolaryngological operations

MONTEFIORE HOSPITAL

A A SCHWARTZ—2 Dry clinic Laryngeal tuberculosis

MORRISANIA CITY HOSPITAL

G B GILMORE and staff—2 Demonstration of interesting cases

NEW YORK HOSPITAL

ARTHUR PALMER and staff—2 Operative and dry clinics
 ALFRED F HOCKER Upper respiratory carcinoma
 ARTHUR PALMER Laryngeal stenosis
 E MILLS ATKINSON Vertigo (aural)
 SAMUEL F KELLEY Sinusitis in allergic cases
 GERVAIS W MCAULIFFE Demonstration of teaching models

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

ARTHUR NILSEN and staff—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

MAX HALLE—I Lecture
 WILLIAM L GATEWOOD—2 Operations

Tuesday

BELLEVUE HOSPITAL

J WINSTON FOWLKES—2 Operations

BETH ISRAEL HOSPITAL

SAMUEL KOPETZKY and staff—2 Operations

FLOWER-FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Operations and demonstrations of interesting cases Motion pictures

HARLEM EYE AND EAR HOSPITAL

ALEXANDER LASZLO—2 Operations and demonstrations of cases

HARLEM HOSPITAL

HERMAN J BURMAN and staff—I 30 Endoscopic demonstrations
 HERMAN J. BURMAN, MAX MARSH, MARK GOTTLIEB, and MICHAEL ROSENBLUTH—I 30 Operative and dry clinics

LENOX HILL HOSPITAL

JOHN D KERNAN and staff—9 Bronchoscopic clinic
 JOHN D KERNAN, GIRARD OBERRENDER and staff—2 Operations

transplant for paralysis of the facial nerve miscellaneous plastic and reconstructive cases demonstrations supplemented with lantern slides and motion pictures side show moulage etc Operation Breast reconstruction

KNICKERBOCKER HOSPITAL

CLARENCE R STRAATSMAN—0 Plastic operations on the face

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

CLARENCE R STRAATSMAN and staff—9 Operative and dry clinics

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON JR—2 Dry clinic and follow up results

THORACIC SURGERY

Monday

BELLEVUE HOSPITAL

JAMES A MILLER J BURNS AMMERSON A V S LAMBERT and F B BERRY—2 Symposium on diseases of the chest

FLOWER FIFTH AVENUE HOSPITAL

SAMUEL THOMPSON—2 Operations
JOHN HERRLIN—2 Acute empyema

METROPOLITAN HOSPITAL

SAMUEL THOMPSON and staff—1 30 Operative and dry clinics

MONTFIORE HOSPITAL

ARTHUR H ACZSE and ISIDOR KROSS—2 Operations

SAINT VINCENT'S HOSPITAL

FRANK MURRAY and DANIEL A MELVILL—3 Treatment of lung abscess, medical and surgical aspects

Tuesday

MOUNT SINAI HOSPITAL

HAROLD NEUFOR ARTHUR S W TOUROFF and AMIEL GLASS—1 15 Operations
HAROLD NEUFOR COLEMAN B RABIN HERMAN HENNEL, DR. BURLINER AMIEL GLASS and ARTHUR S W TOUROFF—1 15 Symposium on abscess of the lung Pathogenesis pathology clinical features roentgenological features localization operative treatment results of operation

NEW YORK CITY HOSPITAL

R L MOORE and C H HUMPHREYS—9 Operative and dry clinics
LYMAN W CROSSMAN and staff—2 Surgical aspects of bronchiectasis lantern slide demonstration with motion picture of a lobectomy in color

SIDNEY HOSPITAL

ARTHUR S UNGER MILTON FRIEDMAN J TOWNSEND TRAVERS SOLOMON FRIEDMAN and DAVID F LERLICH—10 Symposium Diagnosis and treatment of lung tumors

Thursday

BELLEVUE HOSPITAL

A V S LAMBERT—9 30 Operations

LENOX HILL HOSPITAL

Staff—2 Symposium on non tuberculous pulmonary suppuration
H McLEOD RIGGS Etiology of bronchiectasis
GRANT TROBURN Medical treatment of bronchiectasis
JOHN D KERNAN Bronchoscopic treatment of bronchiectasis
CARL FOGERS Surgical treatment of bronchiectasis
WM H STEWART Roentgen diagnosis and treatment of non tuberculous intra pulmonary suppuration
GIRARD F OBERDYNDER The role of foreign bodies in the etiology of intra pulmonary suppuration
WALTER T STENSON The surgical treatment of lung abscess
GEORGE MUEHELEK Intra pulmonary suppuration complicated by empyema
OTTO C PICKHARDT The association of pulmonary suppuration with carcinoma of the lung

MEMORIAL HOSPITAL

Staff—2 Symposium on tumors of lung and mediastinum
LLOYD F CRAVER Diagnosis of interesting lung tumors
J SAMUEL BINELEY Demonstration of the aspiration biopsy technique in lung tumors
EDWARD ELLIS Demonstration of the tumor material obtained by aspiration biopsy in lung tumors

METROPOLITAN HOSPITAL

S A THOMPSON—1 30 Operations

NEW YORK HOSPITAL

GEORGE J HEUER and staff—9 Operative and dry clinics
GEORGE J HEUER Surgical treatment of pulmonary suppuration
WILLIAM DEW ANDRUS Surgery of mediastinal tumors
RALPH F BOWERS Acute and chronic empyema
CRANSTON W HOLMAN Scoliosis in intrathoracic disease
FREDERICK MAYER Collapse therapy in pulmonary tuberculosis

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

LOUIS K DAVIDSON—2 Operative and dry clinics

PRESBYTERIAN HOSPITAL

RICHMOND I MOORE D W RICHARDS JR BYRON STROEVEY ROSS GOLDEN and JOHN D KERNAN—2 Symposium on tumors of the lung

Friday

LENOX HILL HOSPITAL

Staff—2 Symposium on surgical treatment of pulmonary tuberculosis

Friday

FLOWER-FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Operations and demonstrations of interesting cases, motion pictures

HARLEM EYE AND EAR HOSPITAL

JOHN J LEVBARG—9 Voice and speech clinic
Staff—2 Operations and demonstrations of cases

HARLEM HOSPITAL

HERMAN J BURMAN, NATHANIEL HALPERN, and CHARLES HARRIS—9 Tonsil clinic Snaretone and dissection operations

MANHATTAN EYE, EAR AND THROAT HOSPITAL

MARVIN F JONES, D S CUNNING, T G TICKLE and staff—9 and 2 Otological clinics
E ROSS FAULKNER, WESLEY M HUNT and staff—9 and 2 Rhinolaryngological clinics
DAVID H JONES and JOHN M LORE—2 Endoscopic demonstration

METROPOLITAN HOSPITAL

J A W HETRICK and Staff—I 30 Operative and dry clinics

MORRISANIA CITY HOSPITAL

G B GILMORE, HENRY DILLEMUTH, and JOSEPH LASALA—2 Bronchoscopic clinic

MOUNT SINAI HOSPITAL

RUDOLPH KRAMER and Staff—2 Operative and dry clinics

NEW YORK EYE AND EAR INFIRMARY

T L SAUNDERS—10 Demonstration of interesting ear and sinus cases, operations
STUART L CRAIG—2 Operations

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

PAUL S SEAGER—2 Laryngeal surgery, cadaver
CHARLES M GRIFFITH—2 Sinus surgery, cadaver
JAMES O MACDONALD—2 Mastoid surgery, cadaver

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

M COLEMAN HARRIS—9 Allergy in otolaryngology
NATHAN SETTEL—10 Lecture
THOMAS G TICKLE—11 Cadaver demonstration of facial palsy
MALCOLM W CARR—I Oral surgery in otolaryngology
CHARLES J IMPERATORI—2 Operations
M H KAIDEN—3 Lecture

OPHTHALMOLOGY

Monday

HARLEM EYE AND EAR HOSPITAL

HARVEY LYON—2 Refraction clinic

MANHATTAN EYE, EAR AND THROAT HOSPITAL

FRANK C KEIL and Staff—2 Operations

MORRISANIA CITY HOSPITAL

JOSEPH S HORY and staff—2 Operations for cataract, glaucoma and squint, interesting eye conditions in relation to general medicine

NEW YORK EYE AND EAR INFIRMARY

CLYDE E McDANNALD and staff—2 Operations Cataracts, muscle, ptosis
TRUMAN L BOYES—4 Surgical treatment of ocular muscle anomalies with demonstrations of cases

NEW YORK HOSPITAL

Staff—2 Dry clinics
BERNARD SAMUELS Intra-ocular tumors Lecture illustrated with anatomical preparations Demonstration of anatomical specimens and teaching models
MILTON L BERLINER Slit-lamp demonstration
N BLAIR SULOUFF Practical points in refraction

NEW YORK CITY HOSPITAL

RAYMOND E MEEK and FRANK C KEIL—2 Operative and dry clinics

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

ERVIN TOROK—3 Operations

RIVERSIDE HOSPITAL

CLIFFORD W ELLISON—3 Eye conditions in tuberculous patients

Tuesday

BELLEVUE HOSPITAL

WEBB WEEKS and staff—2 Operations for cataract, glaucoma and squint

HARLEM EYE AND EAR HOSPITAL

CHARLES B MEDING and ARCHIE OBERDORFER—2 Operations and demonstrations of cases

HARLEM HOSPITAL

PAUL A COLLINS—2 Fundus operations and ward rounds

KNAPP MEMORIAL EYE HOSPITAL

ARNOLD KNAPP and staff—9 Operative and dry clinics

MANHATTAN EYE, EAR AND THROAT HOSPITAL

PLINEUS MONTALVAN—9 Follow-up clinic on glaucoma
MCCLELLAND SHELLMAN—9 Fundus clinic
H ROBERTSON SKEEL and staff—2 Operations

METROPOLITAN HOSPITAL

A L CHAMBERS and staff—I 30 Fundus clinic, external diseases of the eye

MONTEFIORE HOSPITAL

SIGMUND A AGATSTON—9 Dry clinic

NEW YORK EYE AND EAR INFIRMARY

E B BURCHELL—9 30 The laboratory and its aid to ophthalmology
IRVING SCHWARTS—10 30 X-ray of accessory sinuses and skull, fundamentals
WILLIS S KNIGHTON—11 30 Contact lenses
SAMUEL P OAST and staff—2 Operations Cataracts, modified LaGrange, general

LINCOLN HOSPITAL

WILLIAM H HOLDEN MURRAY BRIGGS and HAROLD LIGGETT—2 Operative and dry clinics

MANHATTAN EYE EAR AND THROAT HOSPITAL

ROBERT BUCKLEY A S WILSON and staff—9 and 2 Rhinolaryngological clinics

JOHN R PACE R H HUVILL and staff—9 and 2 Otological clinics

DAVID H JONES and JOHN M LORE—2 Endoscopic demonstration

METROPOLITAN HOSPITAL

J A W HETRICK and staff—130 Tonsil surgery in children

MOUNT SINAI HOSPITAL

JACOB I MAYBAUM WALTER L HORN SAMUEL ROSEN JOSEPH G DRESS HARRY ROSENWASSER and EUGENE R SNYDER—10 Operative and dry clinics intracranial complications of otitic origin recovered cases of streptococcus meningitis petrositis sepsis of otitic origin value of sulfanilamide in otological conditions neuro-otological cases histopathological studies Dr DRIS RUDOLPH KRAMER and staff—2 Operative and dry clinics

NEW YORK CITY HOSPITAL

OTTO C RISCIT and staff—2 Operative and dry clinic
HILTON H SPROTHERS—2 Bronchoscopic clinic

NEW YORK EYE AND EAR INFIRMARY

J C HANLEY—10 Operations and demonstration of interesting cases
P C CARR and W C DENTON—2 Operations

NEW YORK HOSPITAL

Staff—2 Exhibits and demonstrations in outpatient department pavilion rounds

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID H JONES—9 Bronchoscopy lecture and demonstration
JULIUS I KLEPPER—11 Cadaver demonstration
J ALPH ALMOCK—1 Cadaver demonstration
SAMUEL J KOPETKY—2 Cadaver demonstration

PRESBYTERIAN HOSPITAL

JAMES W BABCOCK—2 Operations

RIVERSIDE HOSPITAL

GEORGE D WOLF and DAVID I FRANK—10 Operations
Direct laryngoscopy and cruentation of larynx Dry clinic Tuberculous laryngitis in various stages

ROOSEVELT HOSPITAL

CHARLES N HARPER and staff—2 Bronchoscopic clinic

SAINT FRANCIS HOSPITAL

HENRY J DILLEUTH and staff—2 Operations and demonstrations of cases

SAINT VINCENT'S HOSPITAL

JOHN M LORE and staff—2 Presentation of cases Stripping of vocal cords laryngosclerosis for carcinoma laryngectomy laryngeal stenosis subglottic tumor in a child cases for diagnosis Lantern slide talks Technique of stripping of vocal cords Lore modification of laryngofissure operation operative procedure for relief of double abductor paralysis

ANTHONY ROTTINO—2 Pathological demonstration

Thursday

BELLEVUE HOSPITAL

J WINSTON FOWLES and staff—2 Dry clinic Postoperative petrositis motion pictures of radical frontal sinus operation

FLOWER FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Demonstrations of interesting cases

HARLEM EYE AND EAR HOSPITAL

ALEXANDER LASZLO—2 Mastoid operations

HOSPITAL FOR JOINT DISEASES

JULIUS A HAIMAN and staff—9 Dry clinics

JULIUS A HAIMAN and staff—2 Operations

LENOX HILL HOSPITAL

GIRARD OBERKENDER and staff—9 Bronchoscopic clinic

MANHATTAN EYE EAR AND THROAT HOSPITAL

JOSEPH D KELLY C W DEPPING and staff—9 and 2 Otological clinics

FRANCIS W WHITE J D WHITHAM and staff—9 and 2 Rhinolaryngological clinics

MORRISANIA CITY HOSPITAL

CLARENCE H SMITH—2 Operations Mastoid

NEW YORK CITY HOSPITAL

HAROLD B JCOB—Operative and dry clinics

NEW YORK EYE AND EAR INFIRMARY

EDGAR BURCHELL—10 Dry clinic Surgical anatomy of the temporal bone and its variations

J M SMITH—10 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

ARTHUR NILSEN and staff—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

HENRY B ORTON—9 Cadaver demonstration
J EASTMAN SHEERAN—11 Lecture on otolaryngology and plastic surgery

W WALLACE MORRISON—1 Lecture

L E M HUBB—2 Operations

H G BULLWINKEL—3 Cadaver demonstration bronchoscopy

PRESBYTERIAN HOSPITAL

GEORGE R BRIGHTON—2 Bronchoscopic clinic Presentation of cases demonstration of technique of bronchospirometry

ROOSEVELT HOSPITAL

CHARLES N HARPER and R C CROVES—2 Dry clinic

ST LUKE'S HOSPITAL

W C LOANES and staff—2 Operative and dry clinics Meningeal infections of otologic origin sinus infections and their treatment

UNITED STATES MARINE HOSPITAL

W P GRIFFY A T HILLY and staff—2 Operations

BROOKLYN-LONG ISLAND DAY—WEDNESDAY

OPERATIVE AND DRY CLINICS—9-12'30

BROOKLYN CANCER INSTITUTE

Operative Clinics—9

- J J GAINNEY and GEORGE REITZ Radical mastectomy, two cases
 J MCGOLDRICK Carcinoma of the cervix
 I SIRUS One-stage Miles resection for carcinoma of rectosigmoid
 G ROBILLARD Surgery of the colon
 E K MORGAN Ureterostomy for carcinoma of bladder

Dry Clinics—9

- W E HOWES Pre-operative radiation of the breast
 Exhibit of bronchial carcinoma and review of six autopsied cases
 H CHARACHE Neurogenic sarcoma Eighteen cases with statistical study and lantern slides
 J SCHMIDT Carcinoma of the larynx, presentation of operated and radiated cases, wax model demonstration
 H S RASI Oral surgery in malignancy, with wax model exhibit
 S WOLFE Carcinoma of the vulva, case presentations
 L S DREXLER Carcinoma of the genito-urinary tract, lantern slide demonstration
 H BOLKER and H KOPPELMAN The effect of radiation on mammary tissue and breast cancer

BROOKLYN HOSPITAL

- ERNEST K TANNER and staff—9 General surgical operations
 E K TANNER, D D DAVIS and W H FIELD Lobectomy for bronchiectasis, transposition of viscera

Clinical Presentations

- E K TANNER Review of one year's anesthesia Review of empyema for eighteen years
 D D DAVIS Massive drip blood transfusion from blood bank
 W H FIELD Study of the results of gall-bladder surgery, two five-year periods
 R B MILES Comparative study of drainage vs non-drainage in acute appendicitis
 A L SMITH Analysis of surgical mortality
 S A WINNING End-results of sympathectomy in Raynaud's disease
 E JLFERSON BROWDER—9 Neurosurgical operations Surgical treatment of epilepsy Demonstration of bipolar cortical stimulation Posterior fossa approach for major trigeminal neuralgia
 NATHANIEL P RATHBUN and staff—9 Genito-urinary surgical, operative and dry clinics
 N P RATHBUN, H FISHER and W F. McKENNA Tidal drainage of the bladder with control of time, quantity, and pressure factors
 H WEHRBEIN Rupture of renal cyst with extravasation of urine forming extrarenal urinary cyst
 F C HAMM Motion pictures of genito-urinary surgery in children
 F C BOND Ureteropelvic obstructions Series of operated cases and x-rays

WILLIAM SIDNEY SMITH and staff—9 Gynecological and obstetrical, operative and dry clinics

- W S SMITH, ELIOT BISHOP, JOHN CASAGRANDE, and GEORGE G COCHRANE Dry clinic Outline of combined medical-obstetrical clinic for care of cardiac patients Experiences with vaginal anti-sepsis Survey of the obstetrical service Diagnosis and treatment of hydatidiform mole
 DONALD E McKENNA and staff—9 Orthopedic surgery
 DONALD E McKENNA Operations Arthrotomy of the knee joint
 HENRY LANGE Xanthoma of knee joint
 L GASTON PAPAE Disease of the spine with symptoms simulating lesions of the urinary tract
 A W MARTIN MARINO and staff—9 Rectal surgery Abdominoperineal resection for cancer of rectum Other proctological operations Demonstration of patients who have undergone different types of operations for cancer of rectum Visit to rectal clinic

CUMBERLAND HOSPITAL

- MERRILL N FOOTE and staff—9 General surgical operations
 CARLTON CAMPBELL Physiological gastric resection
 RUDOLPH GOLDBERG Thyroidectomy
 HOWARD BLAIR Cholecystectomy. The use of stainless steel wire in abdominal closures
 JOHN TIMM and staff—9 Operations Splenectomy for Banti's disease
 STANLEY D BANKS Radical mastectomy for carcinoma of breast
 EUGENE F VITAGLIANO Hysterectomy for fibroid of uterus

Operative Clinic

- HERBERT T. WIKLE and staff—9 Operations Bone dust hernioplasty
 HENRY WAGENER Gastric resection
 HOWARD T LANGWORTHY and staff—9 Genito-urinary surgical operations
 LEO S DREXLER Prostatectomy Nephrectomy
 FRANK H LASHER and staff—9 Otolaryngological operations
 ABRAHAM G SILVER, LOUIS R USEN, BERNARD N GOTTLIEB, SAMUEL KAPLAN Bronchoscopy Lateral sinus thrombosis Nose and throat operations
 WILLIAM C MEAGHER and staff—9 Obstetrical dry clinic
 WILLIAM C MEAGHER Cesarean sections at Cumberland Hospital
 SAMUEL LUBIN Results of attempted induction of labor with estrin
 ALEXANDER DUNBAR Operative deliveries at Cumberland Hospital
 Staff—10 General surgery, dry clinic
 HARRY MARTZ Analysis of 50 consecutive ruptured gastric ulcers, lantern slides
 JACK ROMASCAN Familial neurotrophic osseous atrophy, demonstration of cases
 CARLTON CAMPBELL Presentation of cases of mammary tuberculosis
 SAUL F LIVINGSTON Granuloma inguinale, end-results of cases treated locally

BERNARD SAMUELS and staff—2 Operative and dry clinics

NEW YORK HOSPITAL

Staff—2 Exhibit of rare old English American German and French books on ophthalmology interesting clinical cases

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

Clyde E. McDONALD—3 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN — Dry clinics

PRESBYTERIAN HOSPITAL

(Institute of Ophthalmology)

JOHN M. WHEELER and staff—9 30 Operative and dry clinics

UNITED STATES MARINE HOSPITAL

W. P. GRIFFEX and R. AEBLI—2 Operative and dry clinics

Thursday

BETH ISRAEL HOSPITAL

WEBB WEEKS—2 30 Operations

HARLEM EYE AND EAR HOSPITAL

JOHN J. DECKER, MAX GOLDSCHMIDT and LOUIS SCHWARTZ —2 Operations and demonstrations of cases

HARLEM HOSPITAL

HENRY MINSKY—2 Operative and dry clinics Lid injuries

LENOX HILL HOSPITAL

E. F. KELCO, J. J. REID, JR. and staff—2 Operations

MANHATTAN EYE, EAR AND THROAT HOSPITAL

PLINEUS MONTAGNAN—0 Demonstration of contact glasses and telescopic lenses

ANDREW A. EGGSTON and JOSEPH LAVAL—0 Demonstrations of eye pathology

NORTON DEL. FLETCHER and Staff—2 Operations

MOUNT SINAI HOSPITAL

KAUFMAN SCHLIEVE and staff—0 Cataract extraction trephine LaGrange Salar for detachment ptosis and advancement of levator

NEW YORK EYE AND EAR INFIRMARY

CONRAD BERENS and staff—0 Operations Indocyclo-sclerotomy retropacements Tenon's capsule transplant endocapsulotomy general operations

WEBB WEEKS and staff—2 Operations Intracapsular cataracts modified LaGrange muscle operations

WENDELL L. HUGHES—2 Plastic corneal transplant

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinic

PRESBYTERIAN HOSPITAL

(Institute of Ophthalmology)

JOHN M. WHEELER and staff—9 30 Operative and dry clinics

Friday

BELLEVUE HOSPITAL

WEBB WEEKS and staff—2 Demonstrations of post operative cases illustrated with results from operations for cataract glaucoma and plastic surgery of the eye and orbit

HARLEM EYE AND EAR HOSPITAL

CHARLES B. MEDING and staff—2 Operations and demonstrations of cases

HOSPITAL FOR JOINT DISEASES

DAVID WEXLER and staff—2 Dry clinic

MAURICE POMERANZ and HENRY K. TAYLOR—2 Photography in orthopedic surgery

MANHATTAN EYE, EAR AND THROAT HOSPITAL

R. TOWNLEY PATON—0 Demonstration of cornea transplanting and ophthalmic photography

GIROLAMO BONACCOLTO—0 Slit lamp demonstration

DAVID H. WEBSTER and staff—2 Operations

PRESBYTERIAN HOSPITAL

(Institute of Ophthalmology)

JOHN M. WHEELER and staff—9 30 Operative and dry clinics

ST. LUKE'S HOSPITAL

W. G. FRENCH, JR. and staff—2 Operative and dry clinics

H. T. SMITH The Laurence Moon Riedl syndrome

WALTER HIPP Treatment of conjunctivitis with bacteriophage

JOHN F FORD—9 Plastic surgery, dry clinic The cosmetic aspect of rhinoplastic surgery
O PAUL HUMPHSTONE, RALPH M. BEACH, HARVEY B MATTHEWS, HARRY W MAYES, GEORGE H DAVIS and staffs—9. Operations and ward rounds in obstetrics

ST JOHN'S HOSPITAL

Operative and Dry Clinics—9

JOHN E JENNINGS Radical mastectomy with ligation of axillary vein Treatment of inoperable breast cancer
FRANK SAMMIS Grill graft plastic
STANLEY B THOMAS and GEORGE R MARSH Gastrointestinal surgery Cancer of colon-megacolon, review of cases
AUGUSTUS HARRIS Surgical attack on anomalies of kidney and ureter, cases and results reviewed
S LLOYD FISHER Surgery of the female pelvis
JAMES L COBB and GEORGE B. REITZ Acute and traumatic surgery, operations and demonstrations
L ALBERT THUNIG Anomalies of the umbilicus

Co-ordinated Medical and Obstetrical Demonstrations

CAMFRON DUNCAN Handling of labor in tubercular cases, and postpartum care
LOWELL B ECKERSON Back pain associated with gastrointestinal lesions
CHARLES E. HAMILTON Collapse therapy in tuberculosis of the lung
CARL GREENE The acute gall bladder
PAUL PARRISH Pyloric stenosis in infants
FRED MAISEL Surgical photography
JOHN B KNAPP and WILLIAM RICHARD CASHION Roentgenography and x-ray therapy
LEONID WATTLER Anesthesia procedures

ST MARY'S HOSPITAL

WILLIAM PASCUAL, THOMAS M BRENNAN, PETER DULLIGAN and staffs—9 General surgery, operative and dry clinics

SANFORD SHUMWAY Selected fracture problems

DANIEL WELSH Acute intestinal obstruction due to gall-stone occlusion

HUGH MURPHY Mecholyl iontophoresis in the treatment of thrombophlebitis

PETER DULLIGAN Management of acute intussusception

THOMAS BRENNAN Cases illustrative of retroperitoneal hemorrhage and other types of abdominal trauma

WILLIAM PASCUAL Atypical appendicitis, difficulties in recognition and management.

JOSEPH RIZZO Appendicitis in pregnancy

HUGH MURPHY and V TESORIERO Vascular clinic, demonstration of cases and methods of treatment

ANDREW J MCGOWAN, FRANK C HAMM and staffs—9 Genito-urinary surgery, operative and dry clinic

FRANK C HAMM Transurethral prostatectomy

ANDREW J MCGOWAN Pediatric urology

GIORGE PRICE and WILLIAM MOITRIER, JR—9 Pathological demonstration, skin tumors, ovarian tumors in their relationship to sex

JOHN SHIELDS and staff—9 Proctological dry clinic

Roentgenological Department

FRANCIS CURRIN Exhibits

PAUL RATA Cholangiography in biliary tract disease

FRANCIS CURRIN Radiation in postoperative parotitis

HERBERT C FETT and staff—9 Orthopedic surgery, selected problems

ALBERT KIENAN, JOHN AUWERDA and staffs—9 Otolaryngological surgery

E A KLYRS, H. GOUBEAUD, C LOUGHRAN, R WILSON and staffs—9 Gynecological and obstetrical operations Vaginal hysterectomy (local), anterior and posterior colporrhaphy (local), panhysterectomy (spinal), laparotomy for ovarian cyst

Dry Clinic

H GOUBEAUD and staff—9 Forceps application (mannikin), Kielland, Pieper, axis traction Resuscitation of newborn, cadaver and motion pictures Graphs and charts dehydration, mortality, morbidity, cesarean sections, repeat sections, x-ray in placenta previa Blood bank in obstetrics

M MURPHY Eight cesarean sections, ectopic pregnancy

F MITCHELL Double pregnancy, double uterus, abortion at fourth month, first uterus, full term cesarean section, living baby, second uterus

CHARLES LOUGHRAN Hydatiform mole, cesarean section at term, living baby

M MURPHY Two cases abdominal hemorrhage, tubal in origin, not ectopic

J MASTROTA Antepartum diagnosis, triple pregnancy, with x-ray

H JOYCE Electric cervix, advantages and disadvantages

M ABBENE Hydatiform mole, analysis of nineteen cases

U S NAVAL HOSPITAL

Operative Clinics—9

CHARLES H SAVAGE Appendectomy, spinal anesthesia
JAMES J O'CONNOR Repair of inguinal hernia, local anesthesia

COURTNEY G CLEGG Rectal clinic

Dry Clinics—10

LOUIS E GILJE Fracture clinic

CALVIN B GALLOWAY—10 Cancer clinic

BROOKLYN EYE AND EAR HOSPITAL

OPHTHALMOLOGY

Morning Session—9 30 Dry Clinics

E CLIFFORD PLANCE Keratoconus treated with contact lenses Sarcoma of the choroid

CHARLES A HARGITT Hereditary juvenile glaucoma, two families

RALPH I LLOYD Birth injuries of the cornea and allied conditions

WALTER V MOORE Scleromalacia perforans, report of four cases

WILLIAM F C STEINBUGLER Ophthalmomyiasis anterior

MORTIMER A LASKY Krusenborg's spindle

DANIEL KRAVITZ Hodgkin's disease of the lid

IRVING JACOBS Spherophakia, ectopia lentis with lens extraction O U

JOHN N EVANS Preparation for operation and aftercare of glaucoma cases

Motion Picture Demonstrations

P CHALMERS JAMLSON Jameson recession, motion pictures

WALTER MOLHLE Cataract extraction, a new technique, motion pictures

MERRILL V. FOOTE and SILIA H. POLAYES Acute appendicitis B. Welch blood stream infection extrusion of entire spleen cure presentation of patient

JEWISH HOSPITAL

WILLIAM L. DER and staff—9 General surgical operations resection for carcinoma of the stomach

HENRY LOURL and staff—9 General surgical operations

DAVID FARBER Thyroidectomy

FRANK TELLER Problem of recurrent hyperthyroidism

LOUIS BERGER and staff—9 General surgical operations

DAVID TEPLITSKY Colonic resection for carcinoma

RALPH WOLFE Organization of the gastro-intestinal surgical division

MILTON J. RADER Dry clinic Acute appendicitis twenty year study at Jewish Hospital

ROBERT E. ROYENBERG Dry clinic Retroperitoneal cyst

PALL ASCHNER and staff—9 Genito-urinary surgical operations

ABRAHAM PROGERIV Nephrectomy for tuberculous kidneys

SAUL PARNASS Second stage prostatectomy

LOUIS T. MORSE Urological approach to treatment of essential hypertension

PALL ASCHNER DAVID M. GRAYZEL MAX LEDERER

MILTON G. WASCH Dry clinic Exhibit of tumors of kidney ureter bladder and prostate classification diagnosis pathology treatment

LEO M. DAVIDOFF and ISRAEL M. TARLOV—9 Neurosurgical operations Right transfrontal craniotomy for suprasellar meningioma Demers ration of electroencephalography

E. LEO BERGER and staff—9 Otolaryngological operations

THILIP LEIBOWITZ CARL KAPLAN CHARLES BREITMAN BERNARD WEIT Radical mastoidectomy Demonstration of broncho cope

LEO S. SCHWARTZ and staff—9 Gynecological and obstetrical operations

SAMUEL SCHENKEL SAMUEL A. WOLFE EMANUEL LITZELER Vaginal plastic operation Hysterectomy

KING COUNTY HOSPITAL

Operative and Dry Clinics—9 30

EDWIN FISKE Thyroid clinic

ROBERT F. BARBER Operation colon surgery

EDWARD I. DUNN Operations general surgery

CHARLES B. JONES Operations general surgery

JOSEPH TENOPFER Fracture demonstration ward walk

JOSEPH RAPHAEL Fracture demonstration operation

H. WRIGHT BENNETT Thyroid operation

WILLIAM ENNIS Open reduction of fractures

NICHOLAS RYAN Gastric ulcers statistical study

OTTO KAR TENOPFER Fracture demonstration

WALTER COCKLEY Plastic surgery operations two hours

CHARLES S. COCHRAN Ward walk display of x-ray

perforated kidney ureter and bladder

MERVIN C. MYERSON Laryngofissure for carcinoma of larynx, operation

MATTHEW GOLDEN Operative and dry clinic

WALTER MOERLE Demonstration of ophthalmic operations

J. B. L. ERISCOPO Demonstration of bone block operation for painful hip

RALPH GARLICK Plastic operation for prolapse

JOSEPH MCGOLDRICK Operation hysterectomy

CHARLES MUELLER Gynecological operations

HENRY COLEBAUD Statistical study of placenta previa

CHARLES GRADY Gynecological operations

MORRIS GLASS Ward demonstration cardiac conduction in pregnancy toxaemia in pregnancy

EDWIN GRACE Fetal transplants for coronary disease

LONG ISLAND COLLEGE HOSPITAL

Operative Clinics—9

EMIL GOETZ Thyroidectomy for strabismic goiter

ALFRED C. BLEY Cesarean section

FEDOR SPENCER Ureteral transplant Nephrectomy

RALPH HARLOW Impyema Operation Closed treatment of all types

WILLIAM T. JEWETT Forthright operation

HARVEY B. MATTHEWS Vaginal plastic under local anesthesia

GEORGE W. FIELLA Tumors of the round ligament

MERVYN J. ARMSTRONG Epistomy and repair under local anesthesia

GEORGE HORTON Nephrectomy

Dry Clinics—10 30

S. POTTER BARTLEY Fractures of the foot, clinical and economic aspect lantern slides

HERBERT C. FETT Arthrology of the knee joint report of experiences

ROBERT J. BARBER Malignant tumors of peripheral nerves cases and specimens

SAMUEL A. WOLFE Demonstration of ovarian tumors

METHODIST EPISCOPAL HOSPITAL

HAROLD A. BELL HENRY F. GRAHAM PIERRE A. RENARD

SEYMOUR G. CLARK JOHN A. TIMM and staffs—9

General surgical operations

Dry Clinics

S. G. CLARK Vascular tumors of the foot

H. A. BELL Intussusception with Meckel's diverticulum

MILTON E. HOEPLI Use of long intestinal tube for relief of intestinal obstruction

OSCAR P. SCHOENEMANN Fluorography in tuberculosis

HAROLD E. RHAME Elliott treatment for pelvic inflammation

C. DONALD SAWYER The peritoneoscope

J. H. BLISS Primary carcinoma in a branchial cyst

KENNETH H. MACGREGOR Surgical indications for blood transfusions

H. RUSSELL MEYERS—9 Neurosurgical dry clinic

Chronic subdural hematomas in infancy

DOUGLAS I. MCKENNA and staff—9 Orthopedic surgery

HENRY J. LANGF Fracture of radius and ulna lower fifth in adolescence

DOUGLAS I. MCKENNA, HENRY F. GRAHAM, HAROLD A. BELL JOHN A. TIMM and staffs—11 Fracture clinic

JOHN A. TIMM Use of Satter apparatus for reduction of fractures of both bones of forearm

HENRY F. GRAHAM An efficient method for reduction and retention of Colles fracture

HOWARD T. LA CROIX and R. I. VILL—9 Genito-urinary surgery urological exhibit

KOSAKA I. MULL—11 30 Medical aspects of prostatic

CHARLES L. STONE CHARLES A. ANDERSON FINAR A. SUNDE and staffs—11 Otolaryngological operations

CHARLES L. STONE and CHARLES A. ANDERSON Dry clinic Ligation of the common carotid artery for hemorrhage

Acute Osteomyelitis—St Mary's Hospital—
Moderator: WILLIAM V. PASCUAL

DANIEL E. WELCH. Multiple lesions of acute osteomyelitis
 JOHN M. SCANNELL. Modern treatment of acute osteomyelitis in children
 AINSWORTH L. SMITH. Conservative operating in acute osteomyelitis
 SEYMOUR G. CLARK. Etiology of acute osteomyelitis

OBSTETRICS AND GYNECOLOGY

Hemorrhage Associated with Pregnancy—Methodist Episcopal Hospital—Moderator: O. PAUL HUMPHREY

ONSLAW A. GORDON. Abortion
 ELIOT BISHOP. Unusual antepartum lesions
 RALPH M. BEACH. Placenta previa
 G. HAMILTON DAVIS. Ablatio placenta
 HENRY J. GOUBEAUD. Ruptured uterus
 HARRY W. MAYES. The postpartum period
 HARVEY B. MATTHEWS. The puerperium

Maternal Welfare and Toxemias of Pregnancy—Long Island College Hospital—Moderator: ALFRED C. BECK

There will be a one hour demonstration under the Chairmanship of Dr. Charles Gordon of the actual conduct of the Committee on Maternal Welfare of the Medical Society of the County of Kings. This Committee has for its purpose the improvement of obstetrics by an analysis of the causes of all maternal deaths, the assignment of the responsibility for the same, and suggested remedies

Toxemias of Pregnancy

MERVYN V. ARMSTRONG. The management of hyperemesis gravidarum
 FRANK P. LIGHT. Nonconvulsive late toxemia.
 ALFRED C. BECK. Convulsive late toxemia

GENITO-URINARY SURGERY

Treatment of Malignant Diseases of the Genito-Urinary Tract—The Brooklyn Hospital—Moderator: NATHANIEL P. RATHBUN

HENRY H. MORTON. Address of welcome
 FEDOR L. SINGER. The kidney and ureter
 HEINRICH L. WEHRBEIN. The adrenal
 PAUL WILLIAM ASCHNER. The bladder—clinical application of pathologic data
 EDWIN KING MORGAN. The bladder—endovesical treatment
 AUGUSTUS HARRIS. The bladder—open surgical treatment
 HOWARD LANGWORTHY. The penis
 J. STURDIVANT READ. The prostate
 LT C. B. GALLOWAY. Present day management of teratoma of the testicle

SURGERY OF THE BONES AND JOINTS

King County Hospital—Moderator: JOSEPH B. L'EPISCOPO

CHARLES D. NAPIER. Address of welcome. Vertebral epiphysitis in adolescence
 HERBERT C. FETT. Fractures of the forearm in children
 OTHO C. HUDSON. Fracture of the astragalus
 BENJAMIN KOVEN. Osteomyelitis of the spine treated by graft fusion, lantern slides
 JOSEPH B. L'EPISCOPO. Demonstrations of bone block operations for painful hips
 L. GASTON PAPAE. Acute epiphysitis of the hip joint
 CARL A. HETTSCHEIMER. Relief of lumbar backache by excision of the twelfth rib

NEUROSURGERY

Jewish Hospital—Moderator: LEO M. DAVIDOFF

E. JEFFERSON BROWDER and FLOYD BRAGDON. Physiological effects of drugs and hypertonic solutions in the normal and pathologic state
 RUSSELL MEYERS. Report on a series of operations for so-called "epilepsy"
 RICHARD GRIMES. Review of 350 cases of fracture of the spine with and without spinal cord injury
 GUY LAUDIG. Report on 110 cases of subdural hematoma
 LEO M. DAVIDOFF. End-results in a series of brain tumor operations after a period of ten to twelve years
 Studies in electro-encephalography and pneumo-encephalography
 ISRAEL M. TARLOV. The brain and experimental lead poisoning. Tumors originating in the intracranial portions of the cranial nerves other than the acoustic nerve
 JOSEPH SIRIS. Studies on the blood brain barrier
 ANATOLE KOLODNY. Some infrequent spinal cord lesions, lantern slides

FRACTURES AND TRAUMATIC SURGERY

Cumberland Hospital—Moderator: FUAD I. SHATARA

JOSEPH RAPHAEL. Observations on local anesthesia in the reduction of fractures, report of 100 cases
 HAROLD DRAFFEN. Treatment of compound fractures
 ARCHIE M. BAKER. Fracture clinic in a small hospital
 J. EARL MILES. Pinning of fractures about the elbow joint
 GEORGE B. REITZ. Transportation of head injuries. Madelung's deformity, value in diagnosis of dislocation of the wrist
 JOSEPH I. ANTON. Treatment of nerve injuries
 LEO FASKE. Trimalleolar fracture
 S. POTTER BARTLEY. Management of fractures of the os calcis.

Afternoon Session—30 Operative Clinics and Symposium
JOHN H. OHLY, DAVID T. BISHOP and staffs Symposium
 on retinal detachment
P. CHALMERS JAMESON and **E. CLIFFORD PLACE** Opera-
 tive clinics
CHARLES A. HARGITT, JOHN N. EVA & **WALTER V. MOORE**
 and staffs. Demonstration of patients

OTOLOGY

Morning Session—9 Operative and Dry Clinics

HARRY PATRIE Otitomyelitis of temporal bone Case
 report and patient
ALEXANDER HOWE Frequency of dehydration after
 mastoidectomy

SAMUEL ZWERLING Chillsiness—a symptom of nasal ob-
 struction
ROBERT L. MOORHEAD Petrous pyramid suppuration—
 cases—demonstration on cadaver
JOHN AUWERDA Bronchoscopy—interesting cases
JOHN P. BAKER Cancer of the larynx—laryngectomy and
 larynx, ossure patients
WILLIAM HERBERT Ultra short wave therapy
EDWARD E. WOODLAND Evolution of ear, nose and
 throat specialty in the Medical Corps U. S. Navy—25
 years
MATTHEW GOLDEN Jugular ligation

Afternoon Session—2 Symposium

Staff Bloodstream infections complicating ear conditions.

SYMPOSIA—2 00-4 00

GENERAL SURGERY

Biliary Surgery—Jewish Hospital—Moderator
LOUIS BERGER

LOUIS J. MORSE Clinical analysis of gall bladder disease
 at the Jewish Hospital for the past ten years
THEODORE BARVETT Study of intraductal and sphincter
 pressure in common duct drainage cases
BERT B. HERSHENSON Anesthesia—its relation to sur-
 gery of the gall bladder
DANIEL A. McATEER Physiology of the liver and biliary
 tract
RUSSELL S. FOWLER Why to operate when and what
 operation to do in acute cholecystitis.

Surgery of the Thyroid Gland—Long Island College
Hospital—Moderator **EMIL GOETSCH**

EMIL GOETSCH Operative and postoperative reactions in
 thyroidectomy for hyperthyroidism
ARTHUR R. GOETSCH Hyperthyroidism in children
BENJAMIN CISEL Pathological conditions of the thyroid
 gland
HAROLD K. BELL Care of thyroid cases on a general sur-
 gical service
EDWIN H. FISKE Amount of thyroid gland to be removed
 in mild hyperthyroid cases
HARRY FELDMAN A safe and standardized thyroidectomy
 technique colored motion pictures

Gastric Surgery—Methodist Episcopal Hospital—
Moderator **HENRY GRAHAM**

GEORGE W. CRAMP X-ray diagnosis of gastric lesions
ALBERT F. R. ANDRESEN The 1933 ulcer diet physiologi-
 cal basis Meulengracht diet.
W. WRIGHT BENOIT Lyloric obstruction in infancy
JOHN F. HAMMETT Surgical treatment of ulcer
WILLIAM LINDER Surgical treatment of cancer of the
 stomach
ISIDORE A. RENOUD Important points in the technique of
 gastric operations
J. HERBERT BLISS Gastrojejunal ulceration
WILLIAM H. FIELD Causes of failure after gastric opera-
 tions

Thoracic Surgery—King County Hospital—
Moderator **EDWIN J. GRACE**

EDWIN J. GRACE Address of welcome
IRVING E. SIEB Lobectomy for bronchiectasis

WILLIAM H. FIELD Review of postoperative specimens of
 bronchiectasis
WILLIAM E. HOWES Exhibit of bronchial carcinoma with
 review of autopsied specimens
ARTHUR S. W. TOLKOFF Acute abscess of the lung
EDWIN J. GRACE and **CHAS. D. DIXON** Phrenic nerve
 operations for pulmonary tuberculosis and results of
 300 cases
RALPH F. HARLOW The problem of empyema in pulmon-
 ary tuberculosis

Lesions of the Breast—St. John's Hospital—
Moderator **JOHN E. JENNINGS**

JOSEPH TENOPYR and **IRVING SILVERMAN** Diagnosis of
 tumors of the breast—new biopsy punch
L. ALBERT TULYIC Frozen section technique
WILLIAM F. HOWES Intraoperative radiation of the breast
HAROLD KOPPELMAN and **HERMAN BOLKER** Effect of
 radiation on mammary tissue and breast carcinoma.

Surgery of the Rectum and Colon—Brooklyn Hospital
—Moderator **ERNEST K. TAYNER**

J. HERBERT BLISS Cancer of the rectum surgical methods
 of approach with special consideration of one stage
 resection
GEORGE WEBB Use of Abbott tube in intestinal obstruc-
 tion
JAMES WATT Acute obstruction of the large intestine
A. W. MARTIN MARINO Review of 114 cases of carcinoma
 of the rectum and rectosigmoid
ARTHUR HOLZMAN Surgery of the ascending colon
BENJAMIN SEAMAN The Devine operation in colon sur-
 gery
BERNARD S. PUPEK Treatment of carcinoma of the colon

Surgery of Peripheral Vascular Diseases—St. Mary's
Hospital—Moderator **ROBERT F. BARBER**

HAROLD RABINOWITZ Treatment of thrombo-angitis ob-
 literans based upon new concepts of the pathogenesis
 and pathological physiology of the disease—lantern
 slides
ILGEN L. MURPHY Experience in treating peripheral vas-
 cular disease with paxan—evaluation of results in over
 125 cases. New method in treating thromboembolism
 with mecholyl antipathogenesis.
FRANK N. DEALY Surgery of peripheral vascular diseases
ROBERT F. BARBER Experience with aneurysm

115

12

12



Portrait by T. Phillips, R.A.

Joshua Brookes

1761-1833

SURGERY

GYNECOLOGY AND OBSTETRICS

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THE ALTERNATION OF BLOOD SUPPLY AS A CAUSE FOR NORMAL CALCIFICATION OF BONE

HARRY C. BLAIR, M.D., Portland, Oregon

FOLLOWING fractures, immobilization and disuse cause atrophy of bones. Early activity is known to prevent this decalcification, and it apparently hastens the formation of callus and solid union. The purpose of this study, the results of which are here presented, was to determine the physiological reason or reasons for these phenomena. It has developed the theory that calcification is brought about and maintained by the alternating decrease and increase of the blood supply to the bones. This alternation of blood flow is dependent to a great extent upon the contraction and relaxation of muscles. We often read in medical literature the statement that use of a part will heal a fracture because it increases the circulation. We have accepted this statement without question because of its repetition over a long period of time.

An understanding of our present day knowledge of the factors involved is necessary, and to this end a brief statement is made of the anatomy of the blood supply of bones and muscles, the effects of muscular contraction, the phosphorous calcium balance in blood and tissue, and its relation to the hydrogen-ion concentration. Certain theories of bone formation will be discussed and an attempt made to correlate these facts and theories as they relate to bone calcification and decalcification.

Abnormal metabolic states are not considered, as they do not seem to have a specific bearing on the problem involved.

The bones are poor in capillary nets (17) but contain an abundance of fine arterioles. In long bones arteries supply the spongy structures of the extremities by twigs coming from the articular arteries which branch in the periosteum. The medulla is supplied by the nutrient artery, which passes obliquely into the shaft. These arteries enter the shafts of long bones usually protected and surrounded by a heavy covering of muscle. They are derived mostly from muscular branches and are subject to the same changes that affect muscular arteries during muscular contraction. The nutrient artery of the humerus (7), for instance, arises from the brachial artery in the middle of the arm or one of the muscular branches, passes downward, pierces the tendon of the coraco-brachialis, and enters the humerus below the insertion of that muscle.

The main arterial trunks of supply for the extremities, for the most part, are placed in such relationship with surrounding structures that muscular activity will cause as little pressure as possible upon them. The muscular and nutrient arteries of the bone are not protected in a like manner.

The femoral artery in its proximal half lies in the femoral trigone and is comparatively

superficial, then for a distance of 31 millimeters ($1\frac{1}{4}$ inches) it is enclosed in a fascial sheath. It emerges in the popliteal space as the popliteal artery again becomes quite superficial.

The axillary and brachial arteries are superficial and so placed as to be little affected.

Hyperemia causes decalcification of bone (15). If any process even in the vicinity of bone, increases the activity of the circulation it will cause rarefaction and resorption of calcium. Ischemia or decrease in circulation, favors calcium deposition and ossification.

As Grieg says—

1. Maintain the circulation within certain limits and bones remain unchanged.

2. Produce a definite hyperemia and bone undergoes rarefaction decalcification osteoporosis.

3. Restrict the blood supply, and bone undergoes consolidation.

Hyperemia, either traumatic or infectious, brings about decalcification, the common and striking example being the atrophy of the bones of the hand during the course of an infection in this region. Often erroneously diagnosed as osteomyelitis recalcification takes place as the infection and hyperemia subside and normal activity is resumed.

Syphilitic osteitis with its accompanying bone sclerosis is based on the obliteration of terminal arteries and the consequent ischemia. Acute infectious osteomyelitis is accompanied always by early rarefaction due to the initial hyperemia. Later thrombosis of arteries occurs. The periosteum due to edema is lifted from the bone and its circulation interfered with. Then recalcification and sclerosis occur as the inflammatory reaction subsides and fibrosis takes place. A fragment of bone (12) such as the femoral head or the astragalus completely cut off from its blood supply so that it is completely avascular will retain the original calcium content. It is often said that the intra articular fractures of the neck of the femur do not heal because of lack of blood supply. It is probably due to traumatic hyperemia caused by movement of the fragments fixation by the Whitman method is not accurate and the constant turning of the patient and unavoidable movements in the cast

produce irritation of the fracture surfaces. As later and more complete methods of internal fixation are being employed, better end results are being reported. As a proof that hyperemia is the cause of non union it is of interest to note that the head of the femur, with an admittedly poor blood supply, is not absorbed—and this too when from an x ray standpoint it is alive while the neck, particularly the distal portion is completely absorbed in almost every instance. Kolodny reached the conclusion that the ligamentum teres in the aged is of no perceptible importance, but that the periosteal vessels of the neck are of the greatest importance for the nutrition of the head and neck.

Almost all pathological changes in bone roentgenograms are interpreted on the basis of blood supply, inasmuch as a decrease of blood supply produces a more dense sclerotic bone while an increase above normal brings about rarefaction and a consequent lessened resistance of the x rays. Highly malignant neoplasms of bone are always very vascular and at the same time rapidly destroy and decalcify bone. Less malignant sarcomas of osteogenic origin are of fibrous type with a minimal vascularity grow slowly, and are at times accompanied by bone deposition instead of destruction. Exposure to therapeutic doses of x ray produces a fibrosis, a contraction of blood vessels and recalcification of bone.

When a normal healthy individual receives a broken leg necessitating confinement to bed a generalized decalcification takes place. In the fractured limb a more pronounced atrophy takes place especially if the extremity is confined in a plaster cast. This bone absorption can be due to just one thing—the lack of muscular activity. The atrophy in the unconfined uninjured extremities, even after three months of bed rest is hardly discernible, in the incased limb it is often marked. The difference can be accounted for neither by weight bearing nor stress and strain, but only by the fact that there is a difference in muscular activity of the parts involved. To estimate the importance of muscular activity, a clear conception of the rôles of muscular contraction and relaxation is necessary and particularly of their effect on the circulation.

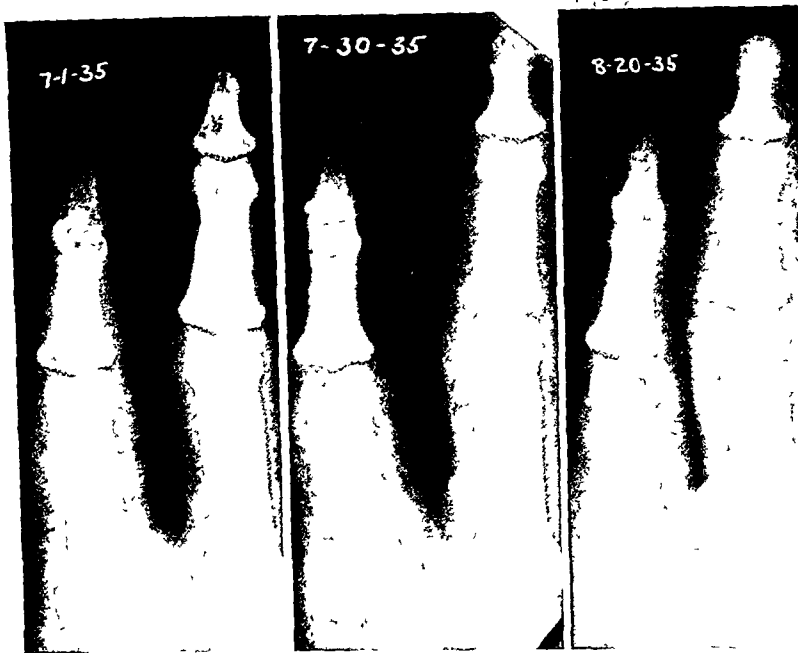


Fig 1 This patient, a milkman, was referred for operation or amputation on account of an infected index finger of 6 weeks' duration. A diagnosis of osteomyelitis had been made by his attending physician. Treatment consisted of continuous hot packs for at least a month. He arrived at my office carrying a hot water bottle to ensure the continued application of heat. Only a small sinus was present on the dorsum of the index finger near the second interphalangeal joint. The hot packs were discontinued. Three days later the sinus had healed. He was then advised to return to his former occupation which required milking 15 cows twice a day. The alternating contraction and relaxation of his hands in milking produced an alternating ischemia and hyperemia with the remarkable recalcification seen in these dated x-rays.

Contraction of muscle (1) causes a diminution of the flow of arterial blood into the muscle. Relaxation causes an increased supply to enter the muscle. At a certain strength of contraction the arterial system becomes reversed and some blood is at times thrown back against perfusion pressure. Continuing the experiment causes an increase of blood to flow through the muscles.

When a muscle contracts, its form is greatly altered (14). The whole vascular system is beautifully adapted to these changes. The arterial and venous networks insure supply and drainage. The capillaries in resting muscle are straight, in contracted muscle twisted. The blood is driven out of the veins by compression and when muscle relaxes these can refill only from their peripheral ends. The veins are a very effective pump on account of venous valves. The contraction of skeletal

muscles (26) squeezes the veins within them and drives the blood toward the heart. Muscles of the extremities are confined in a non-elastic tube composed of fascia and by fascial inter-muscular septa to the bone. When muscular contraction takes place the muscles change their form and contour. This causes pressure on the limiting membrane and on the periosteum covering the bones. When we stand, the pressure on the soles of our feet produces an ischemia. When we walk, the activity of our muscles produces alternating ischemia and hyperemia of the lower extremities by the pressure caused by the change of form and contour of the muscles, by the traction on joint capsules and ligaments and periosteum, and by mechanical pressure against muscular arteries and their associated arteries which supply the periosteum and bone. Ischemia of the hand can be seen when the hand is

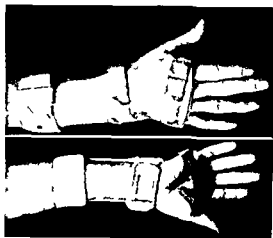


Fig. 2. Posterior aluminum splint used in the treatment of fractures of the scaphoid and other conditions about the wrist joint in which faulty calcification is present. The splint allows alternating contraction and relaxation of the muscles of the hand and forearm. This brings about an alternating ischemia and hyperemia which is so necessary in the production of calcium deposition and callus formation. It is important that the thumb be allowed free movement and that the patient use his hand for all ordinary activities. Shortly after the application of this splint swelling, heat and pain—all evidences of traumatic hyperemia—subside and healing takes place in a normal manner.

clenched and a fist is made. When the hand is opened the blood can be observed re-entering the pale areas. The greatest effect of these factors on alternation of blood flow would be on the vascular and compressible periosteum. If alternation is important in normal calcification this might be an explanation of the importance of the periosteum in bone formation. The chemical products of muscular contracture can have no effect on bone metabolism because they are borne away by the blood stream or destroyed in manufacture of muscle energy.

Henderson and his co-workers have reported the effect that a longitudinal pull of a tonic muscle induces on the transverse pressure between the muscle fibers and by measuring the force required to inject saline between the muscle fibers have estimated this pressure, both in relaxed and in one case in actively contracting muscle. They are of the opinion that the tonus influencing the circulation of the blood is not merely the tonus of the blood vessels—arteries, capillaries or veins

but in addition, the tonus of the tissue through which these vessels pass. The pressure being maintained the blood flowing from the arteries into the tissue capillaries does not lose its pressure. The pressure retained by the blood in the capillaries is the force that drives it back into the veins toward the heart—when on the contrary in illness or after surgical operations tonus is greatly lessened the arteriolar pressure may be practically zero in the capillaries and the blood will remain in the tissues. Loss of tonus takes place when a cast is applied. The muscles soften and lose their normal resiliency. A comparative hyperemia ensues. The blood flow is not retarded by the contraction of the muscles and the venous blood is delayed in its return.

Henderson states that it is a well known fact that during physical exercise any contraction of a muscle squeezes blood into the veins and toward the right heart. They chose a muscle in a state of low tonus for their estimation of intramuscular pressure in man—that of the biceps humeri in relaxation—and noted that if the slightest tension was placed on the muscle the intramuscular tension was increased markedly.

A hypodermic needle of No. 20 gauge was inserted into the body of the muscle and the force required to inject a small amount of normal saline was measured on a manometer. The statement that tonus produces sufficient pressure in the musculature of the body to be a prime factor in maintaining circulation is original with them but a closely related idea namely that vigorously contracting muscles produce an internal pressure is as old as William Harvey and Boricelli.

They report one experiment performed to determine whether the maximal intramuscular pressure would be sufficient to stop circulation through the muscle. A young man of good muscular development was the subject. His arterial pressures were 120/80 millimeters of mercury. Standing at ease the internal pressure of the gastrocnemius moderately relaxed was 143 millimeters of water. Standing on one toe with the whole weight of the body supported by the leg muscles the intramuscular pressure rose to 312 millimeters of water. 312 millimeters of water is 24 meters of mercury,

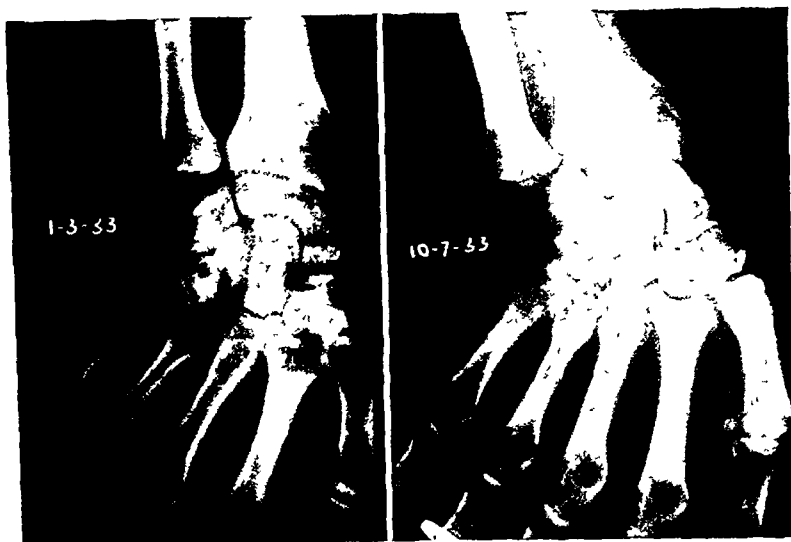


Fig 3 Six months previous to January 3, 1933, this girl received an injury which caused a fracture of the left scaphoid. Diagnosed as a sprain it was untreated. A posterior aluminum splint was worn for a period of approximately 6 months with the eventual result shown. Fractures of the scaphoid, new and old, will unite if the wrist is fixed but if full movements of the fingers and thumb are permitted.

about $\frac{1}{3}$ of the diastolic pressure. This pressure would be insufficient to stop circulation completely.

The general effect of muscular contraction is to retard arterial flow in the muscles and hasten venous return, with relaxation the opposite condition ensues, in other words, alternating relaxation and contraction bring about comparative alternating ischemia and hyperemia.

Diminished blood supply tends to produce an acidosis of tissues, hyperemia a comparative alkalosis. Normal tissue reaction may be considered the same as that of blood, namely, hydrogen-ion concentration 7.3, which, of course, is slightly alkaline.

In a comprehensive series of experiments, Rous (22), using vital stains injected into rats, has shown that skin grafts are acid until their new blood supply is formed. He cites Araki as recognizing that acidity develops in tissues when their blood supply is interfered with. When a string was tied around the legs of a shaven rat stained with phenol red, the color of the leg turned from red to orange in a few minutes, only to become red again a few minutes after the cord was cut.

In another group of experiments (23) rabbits were injected with phenol red and anesthetized. Even under the best conditions, and in the absence of anesthesia, the mere weight of the body of the experimental animal proved sufficient to give rise to acidosis of the surface tissues pressed upon—as shown by the change of color from red to orange—and when the limbs were stretched out under tension the circulation on the surface of the abdomen was frequently interfered with and acidosis developed there as well.

The chemical formula of the mineral portion of bone is supposed to be a double salt of calcium carbonate and tri-calcium phosphate with a formula of $(\text{CaCO}_3)_2 \text{Ca}_3(\text{PO}_4)_2$. The blood plasma and tissue fluids (4) hold about the same amount of calcium in both crystalloid and colloidal solution, part of the calcium being ionized and part un-ionized. The condition of the acid-base equilibrium (5) unquestionably is a factor in determining the degree of ionization of serum calcium. The concentration of calcium ions varies directly as the hydrogen-ion concentration. Increase of carbon dioxide tension appears to enable blood to maintain a higher concentration of calcium.

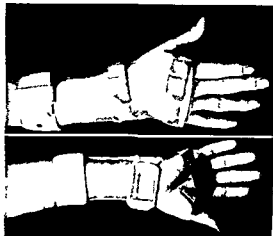


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Fig 6 Fracture of an ankylosed hip treated by the application of a spica cast extending from the axilla to the toes of the affected side. Three months later marked atrophy of both the distal portion of the femur and the head of the bone had taken place. Certainly the head in



this case had sufficient blood supply, yet non-union and atrophy occurred in both fragments. The atrophy involved only slightly the normal femur because, although the patient was bedridden, muscular activity and tension were not abolished by fixation.

increase in the calcium, PO_4 or CO_3 ions. Then by the law concerning difficultly soluble salts the calcium carbonate and the calcium phosphate will be precipitated together.

Phosphatase. The discovery of phosphatase by Robison is significant in that it is apparently a very great step forward in our understanding of bone formation and calcification and certain types of abnormal skeletal changes. Phosphatase is an enzyme which has the property of hydrolyzing phosphoric esters present in the blood stream and tissue fluids. He presents the following speculation: A molecule of phosphoric ester is seized upon by the enzyme molecule and combined with it, the alcoholic group is split off, leaving the phosphate group unattached. This then combines with the wandering calcium and carbonate group to form the bone salt. This enzyme is most active in an increasingly alkaline medium, beginning with hydrogen-ion concentration of 7 and reaching an optimum at hydrogen-ion concentration of 8.4. Robison quotes Hofmeister as suggesting that variations in amounts of carbon dioxide in the lymph might account for the precipitation of calcium salts, a higher concentration of carbon dioxide enables lymph to take up more calcium salts.



Fig 7 Austin Moore's method of internal fixation in intracapsular fractures of the hip. If fixation can be made without the application of a cast this would allow muscular activity of the affected extremity. The fixation should be as near absolute as possible and made with so little foreign material that no reactive hyperemia would ensue. Theoretically under these circumstances, healing should take place in this fracture as readily as in any other.

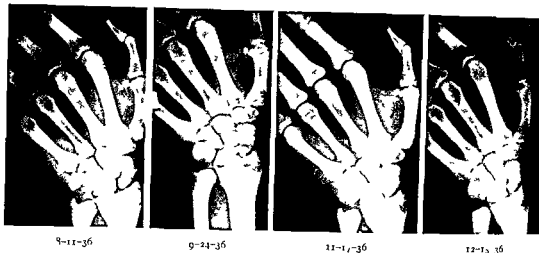


Fig. 4 This boy fractured his left scaphoid 1 year previous to August 1936. He had been advised to have this bone removed. A posterior aluminum splint was prescribed. Within a week the swelling and stiffness had

almost completely subsided. Four months later union was nearly complete. He has worked using his fingers and his thumb, but at the same time the wrist has been immobilized.

than is ordinarily possible. Howland has shown that a difference of 0.02 in hydrogen ion concentration of the body fluid is sufficient to determine the site of the precipitation of calcium and he visualizes calcification in this way: serum contains calcium and inorganic phosphorus in solution in much higher concentration than water would hold them, on account of the high carbon dioxide tension. There is

some evidence to show that part of the calcium is protein bound, the calcium is poorly ionized and this would be equivalent to reducing the total calcium concentration. Intercellular fluid contains roughly the same amount of calcium and phosphorus as the serum, but the protein is much less. The carbon dioxide tension is relatively high on account of cellular activity, but, supposing the carbon dioxide tension is low because the tissue is inactive or dead, conditions are then favorable for precipitation. Cartilage and bone are both inactive tissues and it is in them that one would expect the carbon dioxide tension to be low, and it is in them that precipitation takes place.

Plemister in a recent article suggests the possibility of an enzyme carbonase and calls attention to Hastings' formula for conditions favorable for bone repair. This consists of

1. Optimum physical conditions for the surface precipitation of calcium salts or surfaces which are provided by newly formed fibrils and cement, and

2. Optimum chemical conditions which are provided by the existence of calcium ions, phosphate ions and carbonate ions in tissue fluid. In order to have the precipitation of the double salt $(CaCO_3)_2 Ca_3(PO_4)_2$, it is necessary that its solubility product constant be exceeded. This might be accomplished by an



Fig. 5 An old fracture of the neck of the femur with non-union and absorption. From an x-ray standpoint the head is alive. There has been little or no absorption of that portion of the neck attached to the head. A spicule on its inferior portion has remained unchanged. The head of the femur has less blood supply than the trochanteric region and the distal portion of the neck. The distal portion of the neck is almost completely absorbed. This is due to a traumatic hyperemia. Increase of blood supply does not bring about union.



Fig 9 Syphilitic bone change February 11, 1925 The increased sclerosis, the result of obliterating arteritis, is the common finding in this disease The decrease of blood supply causes an abnormal deposition of the bone salt

In any fracture in which immobilization is not complete two factors are at work (1) a traumatic hyperemia is set up which brings about bone absorption, and (2) muscular activity producing alternation of circulation and a consequent tendency toward callus formation Thus union often takes place in spite of movement of the fracture fragments Union does not take place in cervical fractures of the hip or in fractures of the carpal scaphoid when immobilization is incomplete, because of the small amount of organic material present, which, when irritated, develops a traumatic hyperemia, a dilatation of small vessels such as we see in granulation tissue—the deleterious effect outbalancing the effect of activity

EVALUATION

Disuse is known to produce rarefaction and bone atrophy This rarefaction is due to the absorption of the mineral elements of bone The cellular constituents remain and as activity is resumed the complicated bone salt is replaced Activity is due to one thing only—the contraction and relaxation of muscles controlling the extremity involved It is not due to the chemical by-products of muscular contraction, as they are either used up in the muscular metabolism or swept away by the veins toward the heart

Rous has shown that ischemia, even slight, such as the weight of the body of the experi-



Fig 10 This patient, a young man now 27 years of age, when an infant, suffered an attack of anterior poliomyelitis, which involved one extremity, completely, below the knee He walks without support although the affected extremity is somewhat shorter than the normal one The bones of the paralyzed leg are atrophic and decalcified The obvious cause is the lack of muscular activity Involvement of nutritional nerves has been given as the reason for this bony abnormality, but so far as can be determined no such nerve has ever been isolated The lack of muscular pressure, alternate contraction and relaxation is suggested as the cause of both the atrophy and shortening

mental animal, will produce a localized acidosis in the pressure area; as an example he cites the acidosis occurring in the abdominal wall by the slight tension produced by stretching the limbs of the animal He also notes the speed at which these changes are discernible in the stained animals, only a few minutes being required for the eye to differentiate them

The impression given, although the author refrains from drawing positive conclusions, is that the change toward the acid reaction and toward the alkalineside is accomplished quickly and by very little change in the blood supply

By the contraction and relaxation of muscles it would seem that these changes could be brought about in bone It does not seem pos-



Fig 8 An impacted fracture of the neck of the femur—the abduction type (Boehler). This fracture healed because the fixation is complete. The blood vessels across the line of fracture are certainly destroyed at the time of fracture but healing takes place without any external fixation because a traumatic hyperemia is not produced by the movement of the fragments upon themselves.

Wiggers states that the theories as to the process of calcium deposits may be grouped as humeral and cellular. According to the former, lime is precipitated as a result of physicochemical changes, according to the latter the osteoblasts are in some way concerned. The osteoblasts (hypertrophic cartilage cells) secrete phosphatase which hydrolyzes the phosphoric esters and increases the phosphoric ions (Robison 1926—Kay 1929-1930).

Wiggers believes that several factors are involved, both general and local—the substrata furnished by the blood, and a local factor. Of the general influences the content of the blood calcium and phosphate and the hydrogen ion concentration of the plasma are important. The local ones are a high hydrogen ion concentration diminishing the solubility of calcium in the presence of phosphate and calcium ions and the specific effects of phosphatase.

Circulation. Normal circulation to bone is a varying circulation—an alternating ischemia and hyperemia. When a fracture occurs for a while repair is carried on without the benefit of circulatory blood. The hematoma surrounding the fracture (24) becomes acid then alkaline. The acidity of the hematoma leads to the absorption of salts from the bone. The process is at first purely a physicochemical action

then cells grow into the hematoma and deposit the calcium phosphate in an orderly manner. If the extremity in which the fracture is located is encased in plaster, allowing little muscular function or activity, the part, on account of the lack of muscular tension, really has an increase of blood supply without any alternating ischemia.

Every fracture causes a reactive hyperemia which clinically produces swelling and heat in the region injured. This reaction is brought about by the extracellular presence of a substance called histamine or the "H" substance of Lewis. This liberated material causes immediate dilatation of the smaller vessels. The reaction is on a more or less physiological basis. Dale has shown that another substance, acetylcholine, is a powerful dilator the action of which is pronounced and long. He says: "We first have the liberation of histamine from the immediately affected cells directly causing vasodilatation of the minute vessels with which it comes in contact and acting as a persistent stimulus to the sensory ending of the terminal axon branching. We must further imagine that the nerve impulses thus engendered passing through the bifurcation to the ending of the arteriole there liberate as the effective dilator acetylcholine."

Theoretically it would seem that the use of alternating suction and pressure (19), by increasing and diminishing the blood supply, might aid in the production of union.

Rollier has allowed muscular activity in the course of sunlight treatment, believing that it aids in the recalcifying effects of the sun.

Application of this theory to treatment of fractures of the neck of the femur deserves special consideration. The clinical trend is to treat this fracture by internal fixation, by the Smith-Petersen nail, by wires or bone transplantation. In such a fracture of the aged, the blood supply is less than that found at an earlier period in the patient's life. If absolute fixation could be obtained with material which did not cause an inflammatory reaction and absorption of bone, and at the same time use of the extremity and active muscular contraction and relaxation be maintained, the ideal requirements would be achieved. Complete and absolute fixation is necessary in fractures of the neck of the femur—not primarily because the blood supply is so poor that the fracture will not unite, but because the organic elements are few and the slightest movement destroys the organization of the callus. The ischemia present will actually help the precipitation of the bone salt. Also fracture of the neck of the femur occurs in the aged where muscles are atrophic and inactive—so much more the reason for evolving a treatment by which their activity would not be restricted.

Fracture of the carpal scaphoid belongs in some respects to the same category. Fixation is poor by any method. The slightest movement of the hand causes disturbance of alignment with a resultant reactive hyperemia, producing, if continued, cystic degeneration and non-union. However, if fixation in a dorsal splint is maintained and use of the hand continued, healing will occur in almost every case, even after a long period since the original injury has elapsed.

SUMMARY

1. A theory that alternating ischemia and hyperemia maintain normal calcification of bone and aid in the healing of fractures is presented.

2. This alternation is produced by the contraction and relaxation of muscles.

3. Certain facts and theories have been cited to support this thesis.

4. Correlation of these facts and theories has been attempted.

5. Clinical application of this theory has been suggested.

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Fig. 11. Fascia of the thigh. Muscle is surrounded by comparatively inelastic fascia. When muscle contracts the pressure waves create a force at a right angle to the long axis of the muscle while the contraction that ensues creates traction in a parallel direction. These forces cause a mechanical pressure against the periosteum and the vessels supplying the bone.

sible that reossification of bone is produced in any other way. Weight bearing and stress and strain can be ruled out because even the slight activity of a person confined in bed will prevent the atrophy of the bone or bones of a limb not encased in plaster.

The hydrogen ion concentration of blood is known to vary little during health on account of buffer substances which hold the reaction close to 7.35, any great variation being incompatible with life. It is conceivable, however, that tissues and tissue fluid reactions vary to a greater extent during ordinary metabolic activity. Alternating ischemia and hyperemia therefore can produce a comparative alternation in the hydrogen ion content of tissue fluids. It is assumed that during a rest period when muscles are relaxed, particularly immediately following exercise when arterial flow is markedly increased, a swing toward the alkaline side is taking place. Phosphatase acts best in hydrolysis of the phosphoric ester in an alkali-

line medium. At this period inorganic phosphates should increase in the tissue fluid. Muscular contraction taking place produces an ischemia, a lower hydrogen ion concentration and as a more acid reaction develops, more calcium is ionized and the tissue fluids are able to hold in solution a higher supersaturation of calcium. As muscular relaxation takes place and the swing is again toward a higher hydrogen ion concentration, the law governing difficultly soluble salts causes a precipitation of the complex bone salt composed of calcium carbonate and calcium phosphate.

CLINICAL APPLICATIONS

The theory here presented is applicable in a practical clinical way. If hyperemia produces resorption of bone, the use of heat in recent fractures is a wrong practice. Heat produces hyperemia. Skin temperature is generally accepted as an indicator of blood flow to a part.

Heat should be used only when it is the purpose to absorb calcium, as for example in calcification of the subdeltoid bursa or other heterogeneous calcifications. The use of heat in acute bone atrophy is a vicious practice because it increases the pain and absorption of bone.

Massage has been praised from time immemorial for increasing the circulation and certainly after massage the skin is warm and the part to which this treatment has been applied gives every indication of an increased blood flow. It would seem that massage is not indicated before complete union has taken place and all bone atrophy has disappeared. The active use of a limb by alternating the blood supply will help heal the fracture and recalcify the bone. In fractures about the ankle if accurate reduction is obtained and complete fixation is possible, walking should be permitted since it allows contraction of the muscles of the leg and foot, though the ankle joint does not move. A non-padded walking cast as described by Boehler allows walking without displacement of the fracture.

Contrast baths have been used for years to hasten healing of fractures and to mobilize stiff joints and decrease pain in injured extremities—this usually with the idea that it increases circulation. It is possible this procedure causes an alternation of the blood supply to the part.



Fig 1

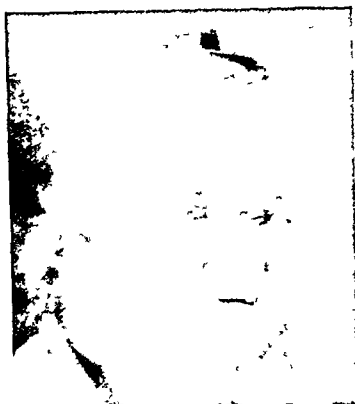


Fig 2



Fig 3



Fig 4



Fig 5

Figs 1, 2, 3, 4, and 5 Mixed tumors of the parotid gland

surrounding tissue, as emphasized by Fry and Zymbal, has no significance in explaining the histological picture other than emphasizing the reason for the clear spaces surrounding the epithelial cells, which have frequently been mistaken for the lacunæ of cartilage cells.

The hypothesis that the mixed tumor of the salivary gland arises from embryonically misplaced tissue was developed by Cuneo and Veau, who felt that the complex embryonic development of the face gave ample justification for this type of origin.

Many of the tumors can quite reasonably be derived from branchial clefts. If this origin of the tumors is assumed, their extraordinary variability of histological appearance is well accounted for. This view was ably expounded by McFarland.

In this group of tumors at present under discussion, we feel the evidence to be definitely in favor of embryologic misplacement of cells as the mode of origin. In this particular group we have not seen the formation of hyaline cartilage, although in 1 case fibrocartilage was

SALIVARY GLAND TUMORS

NEIL W. SWINTON, M.D., F.A.C.S. and SHIELDS WARREN, M.D. Boston, Massachusetts

SALIVARY gland tumors are not of rare occurrence. During the 10 year period between January 1, 1927, and January 1, 1937, 81 patients with tumors of this type have been operated upon at The Lahey Clinic. McFarland had collected 301 similar cases up to 1936 and other large series have been reported (1, 3, 9, 11). In the published articles on tumors of this type, however, considerable confusion still exists concerning the histogenesis, pathology, treatment and prognosis of this disease. In an attempt to obtain further knowledge of this type of tumor, we have reviewed and are reporting this group of 81 cases.

The cases have been grouped for analysis according to the pathological condition present. We have obtained follow-up data on all but 6 of the patients. In this paper we wish to discuss the histology and histogenesis of tumors of the salivary gland as has been brought out by this study and to discuss from a clinical point of view the treatment which we believe should be employed in patients with tumors of this type, and the results which may be expected.

As will be noted from the individual case reports at the end of this discussion, 72 of these tumors are classified as benign and 9 as malignant. The majority of the benign tumors are the so called mixed tumors of which there were 51 in this series (Figs. 1 to 5).

Few tumors present more variable and complicated histology than those of salivary gland origin, and there is still much discussion as to their histogenesis. The present inclination is to consider them as adenomas with varying types of stroma, the characteristic appearance being brought about chiefly by the discharge of secretion of a mucoid nature from the epithelial cells into the interstices of the stroma.

Attention has been called to the similarity of the mucoid changes in the stroma of the so called mixed tumors to the mucoid changes

in the stroma of basal cell carcinomas. On careful study, however, a distinct difference is found in the character of this change. In the case of the so called mixed tumor the stroma is often distinctly myxomatous, whereas in the case of the basal cell carcinoma it is usually a mucoid degeneration of pre-existing collagen.

The frequent tendency of epithelial cells to take on a spindle form has also been used to explain the apparent mesenchymal structure of certain of the elements of the so called mixed tumors. There are, however, certain objections to the consideration of the mixed tumors as adenomas with peculiar stromal changes. Adenomas readily recognized as such are extremely rare in the salivary gland. Moreover, this particular type of change in the stroma is almost unknown in adenomas developing elsewhere. It seems peculiar that in this group of glands alone a peculiar stromal change should develop in the adenomas which arise from them. In the very few instances of the true adenomas which have been reported there is no suggestion of the structure seen in the mixed tumor.

The concept of a true mixed tumor developing from embryonic tissue is far more appealing. Distinctly in favor of this is the not infrequent occurrence of mixed tumors in diverse localities, such as the hard palate, the tonsillar fossa, the soft palate, the cheek, or the gum. Why adenomas of the salivary gland should develop in these localities and then undergo a peculiar change of their stroma in addition is a little difficult to understand. Moreover, in those instances in which mucinous material is secreted by epithelial cells and discharged into the stroma, best seen in the mucinous or colloid carcinoma, the picture does not resemble that of the mixed tumor of the parotid gland. Instead of a diffuse change in the stroma, masses of mucinous material spread apart the stromal bands and collagenous material which maintains otherwise its normal characteristics.

The demonstration in parotid tumors of mucinous secretion and its discharge into the

From the Department of Surgery, The Lahey Clinic, and the Laboratory of Pathology, New England Deaconess Hospital.



Fig 1

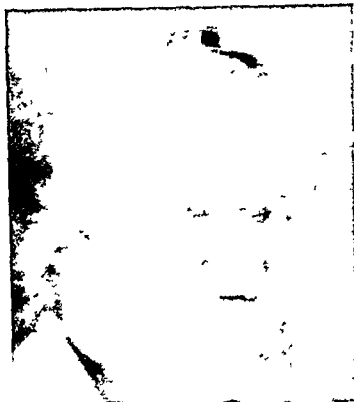


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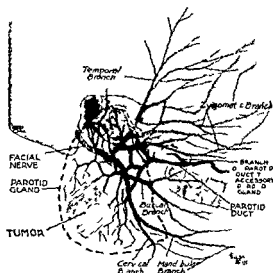


Fig 6 Diagrammatic drawing of the parotid gland and facial nerve showing a small tumor



Fig 7 Normal parotid duct following the injection of lipiodol

present. The epithelial elements vary considerably in type, in 2 instances (Cases 73 and 74) being sufficiently true to the normal architecture of the gland as to be designated as actual adenomas. In other instances there are merely groups of cells of epithelial origin with little or nothing suggesting salivary structures. Stratified squamous epithelium may be present and epidermoid carcinoma may develop. Case 73 deserves special mention as there is some question as to whether the lesion is neoplastic or not. This has been studied in detail by Harris with whose interpretation of the marked proliferation of abnormal duct cells as a tumor we are in accord.

Study of this group leads us to agree with McFarland that the appearance of these mixed tumors is extraordinarily variable and that any attempt to subdivide them on detailed histological or cytological criteria is futile.

The clinical course in histologically divergent tumors is essentially similar. From the clinical course or from examination of the patient the physician cannot predict whether a largely gland-forming epithelial tumor with well formed, definitely collagenous stroma will be found or a myxomatous mass of tissue with only scattered epithelial cells will be present. In our experience the tumors in which the

epithelial element definitely predominates may give rise only to carcinoma whereas one rich in myxomatous mesenchymal tissue has given rise to fibrosarcoma (Case 72).

In the 51 mixed tumors, practically every step from predominantly epithelial to predominantly fibroblastic tumors is represented.

Mixed tumors of salivary gland origin are found predominantly in the parotid glands and in our series 78.4 per cent were found in this location. In the remainder of our cases (21.6 per cent) the tumors were found in the submaxillary gland. They may be found as mentioned previously, in the sublingual gland and in other locations. Seventy-two and six tenths per cent of the mixed tumors occurred in women and 27.4 per cent in males. In other groups that have been reported the ratio has been nearly equal. Mixed tumors may occur at nearly any age. Several instances reported in the literature occurred in children and in our series 7 mixed tumors were found in patients 30 years of age and younger. Three of our patients were more than 60 years of age and the average age incidence was 44 years. Tumors of this type are usually slow growing and become progressively larger. One of our patients had been aware of the swelling in her neck for 34 years. However the average duration of growth in this series was 10.7 years. There seems to be very little predilection of these tumors for either side of the neck; in 43.1 per cent of our cases the tumor was on the right side and in 36.9 per cent on the left.



Fig 8 Diffuse chronic inflammation of parotid gland--note dilatation of ductules



Fig 9 Outline of parotid duct surrounding benign tumor

Mixed tumors are prone to recur. It has been shown that recurrence may take place many years after operation. McFarland reported 1 case in which the tumor recurred 47 years after removal. In 8 cases of our series the tumor had been previously removed elsewhere, in one of which operation had been performed 30 years before the patient came to the clinic. Recurrence has taken place in only 2 cases of our series to date. In Case 24 of our series the tumor recurred locally with invasion of the mandible 3 years after excision. This patient was treated with large amounts of roentgen-rays and is alive and well at the present time, without evidence of recurrence, 5 years after operation. These tumors occasionally become malignant, however, as occurred in Case 15 of our series.

In 2 patients in our series the tumor was less than 2 centimeters in diameter and had been present for an average of 2.7 years. Forty-nine per cent of the tumors varied in size from 2 to 6 centimeters in diameter and had been present for an average of 9.3 years. Forty-seven per cent of the tumors were more than 6 centimeters in diameter and had been present for an average of 13.1 years. In McFarland's series the incidence of recurrence was greater when the tumor excised was small. As we have already mentioned, so few small tumors were present in our series that data on this point are of no value, but the fact that all



Fig 10 Epidermoid carcinoma arising in mixed tumors of parotid +140

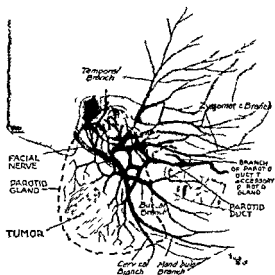


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Four cases of papillary adenocystoma were encountered, 1 of which, were it not for similar cells and similar papillary projections in the parotid ductules, might well have been considered as the type of papillary adenocystoma arising from aberrant lateral thyroid tissue. In none of the cases, however, have follicles been discovered nor has colloid been present. In a few instances small papillary projections of similar appearing cells in the ducts have been encountered in otherwise normal salivary glands, and we believe that it is chiefly from the duct epithelium that these tumors develop. We regard these tumors as being potentially malignant, though of a very low grade.

All of the papillary adenocystomas in our series were found in the parotid gland. Three of the patients were women. In 3 cases the tumor was on the left side of the neck. Two of the tumors varied in size from 2 to 6 centimeters in diameter and the 2 remaining were more than 6 centimeters in diameter. All 4 of these tumors occurred in patients 50 years of age or more and varied in duration from 27 months to 25 years. There were no recurrences in this group of cases although one man, aged 71 years, died of an unknown cause 2 years following operation.

In 1 case a tumor closely resembling an adamantinoma was encountered. In fact, in our experience, the most troublesome histological differential diagnosis has been between adamantinomas and aberrant salivary gland tumors. One case of the rare adenocystoma lymphomatosum was encountered, Case 56, which has been previously reported by Harris (7).

Seven cases of cysts of the salivary gland are included in this series. All of these cysts were found in the parotid gland. Five patients were men and 2 were women. In 6 the tumor was on the left side of the neck and in 1 on the right. The duration of the cyst ranged from 2 months to 32 years. The patients were from 41 to 72 years of age; the average age incidence was 56.8 years. All of the cysts at the time of removal were more than 2 centimeters in diameter and 3 were more than 6 centimeters in diameter. Salivary gland cysts are of interest chiefly from a diagnostic standpoint. In several cases the cyst was mistaken for a mixed

tumor previous to operation. This study has demonstrated to us also that the incidence of recurrence of these cysts is high if, as was done in several of our cases, excision and drainage only are performed. In 2 of the 6 cases in our series, the tumor which was not completely removed, recurred.

One lesion of the parotid gland which was encountered seven times in this series (Cases 75 to 81) has been of particular interest to us and deserves special emphasis. It is a benign, chronic inflammatory process of the parotid gland. On microscopic examination, diffuse lymphocytic infiltration of the interstitial tissue of the gland is found, with a virtual disappearance of the acinar elements. Frequently the ducts may be barely recognizable, presenting various degrees of metaplasia of their epithelium, in some instances persisting only as cords of keratinized epithelium. This condition is somewhat similar to that encountered in Mikulicz' disease, but is not accompanied, as in that, by involvement of the lacrimal gland, nor is it accompanied by leucemic changes elsewhere, as in the group of cases reported by Thaysen. While these lesions are not properly considered as tumors, nevertheless their importance in differential diagnosis is so great and they are apparently so little recognized that some emphasis of them seems warranted.

Of the 7 cases of chronic inflammation in our series, all were found in the parotid gland. All of the patients were women. Four occurred on the right side of the neck, 1 on the left, and in 2 cases the lesion was bilateral. The duration of this lesion varied from 1 week to 8 years. Four of the patients had had the lesion for less than 1 year, and the average duration in the 7 cases was 22.3 months. The ages of the patients varied from 40 to 72 years, the average age incidence being 55.9 years. At the time of operation all of the tumors were more than 2 centimeters in diameter, 3 varied in size from 2 to 6 centimeters, and 4 were more than 6 centimeters in diameter. Recurrence did not take place in any case of the series. Temporary facial paralysis developed in 1 case following operation, and permanent and complete facial paralysis developed in 3 cases in our series.

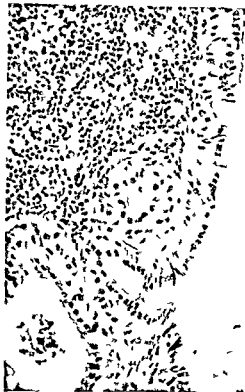


Fig 11 Adenocystoma lymphomatousum +445



Fig 12 Chronic inflammation of parotid gland +365

but two of the mixed tumors were more than 2 centimeters in diameter at the time of excision may account for the fact that to date recurrence has taken place in only 2 patients. The incidence of recurrence in our series of 51 cases of mixed tumors to date is 4.3 per cent but we fully realize that this percentage will probably be increased as more time has elapsed. The incidence of recurrence in McFarland's collection of 297 mixed tumors of the salivary gland is 23.23 per cent. If we include in our figures those cases in which recurrence took place before the patient came to the clinic the incidence is 17.6 per cent.

Two important complications may follow operations for the removal of such tumors. A persistent salivary fistula is a very distressing complication but fortunately it occurs rarely, only once in our series. Paralysis of the facial nerve is a much more common complication (Fig 6), and if it is of a marked degree it may be distressing to the patient. In this series

permanent and complete facial paralysis developed in 5 patients after operation. In addition a minor and partial degree of facial paralysis occurred after operation in 5 other patients. It usually resulted from injury to the lower branches of the facial nerve, the submaxillary branch and caused a droop to one side of the lower lip which completely disappeared after a few weeks. As will be discussed later in this paper, we have never hesitated to sacrifice the facial nerve if we believed, at the time of operation, that the tumor was malignant in character. In 4 of the 5 patients with a permanent facial paralysis the tumor was recurrent. In these cases of recurrent tumor the technical difficulties of operation are greater because of the scar tissue encountered. Radical excision of the tumor is indicated because the tumor is recurrent and the incidence of injury to the facial nerve is therefore greater than in the uncomplicated cases.

TABLE I—SALIVARY GLAND TUMORS—Continued

Mixed tumors

Case	Age, years	Sex	Location		Duration	Size	Date of operation	Recurrence previous to operation	Postoperative complications	End-results
			Gland	Side						
38	29	F	P	L	5 yrs	III	7-8-35	3 yrs	Facial paralysis, permanent	No recurrence in 1 yr
39	54	M	P	R		II	7-10-35	o	o	No recurrence in 1 yr
40	34	M	P	L	1 yr	III	9-13-35	1 yr	Facial paralysis, permanent	No recurrence in 1 yr
41	60	M	P	L	4 yrs	III	9-19-35	o	o	No recurrence in 1 yr
42	51	F	P	R	10 yrs	II	11-8-35	o	o	No recurrence in 1 yr
43	57	M	P	R	20 yrs	III	12-11-35	o	o	No recurrence in 1 yr
44	60	F	S	L	1½ yrs	I	12-18-35	o	Facial paralysis, temporary	No recurrence in 1 yr
45	43	M	P	L	11 yrs	II	2-6-36	o	o	No recurrence in 1 yr
46	19	F	P	L	3 yrs	II	3-18-36	o	o	No recurrence in 1 yr
47	54	F	S	L	?	III	5-19-36	o	o	No recurrence in 1 yr
48	45	F	P	R	5 yrs	II	7-22-36	o	o	No recurrence in 1 yr
49	50	M	P	L	3 yrs	III	7-28-36	o	o	No recurrence in 1 yr
50	42	F	P	R	11 yrs	III	9-28-36	o	o	No recurrence in 1 yr
51	66	F	P	L	16 yrs	II	12-24-36	o	Facial paralysis, temporary	No recurrence in 1 yr

Papillary adenocystoma

52	71	M	P	L	25 yrs	III	12-14-29	o	o	Died, 2 yrs, unknown cause
53	53	F	P	R	10 yrs	III	3-6-30	o	o	No recurrence in 6 yrs
54	50	F	P	L	8 yrs	II	8-1-30	o	o	No recurrence in 3 yrs
55	66	F	P	L	27 mos	II	5-14-31	2 yrs	Facial paralysis, temporary	No recurrence in 3 yrs

Adenocystoma lymphomatosum

56	61	M	P	R		II	7-24-35	o	o	No recurrence in 1 yr
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Cyst

57	43	M	P	R	2 yrs	II	11-16-28	o	o	No recurrence in 8 yrs
58	67	F	P	L	2 yrs	III	12-14-26	o	o	No recurrence in 10 yrs
59	45	M	P	L	1 yr	II	11-20-29	o	o	Recurrence in 4 yrs
60	61	F	P	L	3 yrs	III	5-3-30	o	o	Unknown
61	69	F	P	L	2 mos	II	12-21-32	o	o	No recurrence in 2 yrs
62	72	F	P	L	32 yrs	II	7-13-33	12 yrs	o	No recurrence in 3 yrs
63	41	F	P	L	1½ yrs	III	10-17-33	1 and 2 yrs	o	Recurrence in 2 yrs

Papillary adenocarcinoma

64	68	F	P	L	2 yrs	IV	9-13-32	o	o	Died in 5 yrs (carcinoma of cervix)
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Epidermoid carcinoma, I

65	72	F	P	R	3 mos	IV	10-10-34	o	Facial paralysis, permanent	No recurrence in 2 yrs
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TABLE I—SALIVARY GLAND TUMORS

Case	Age years	Sex	Location		Duration	Size	Date of operation	Recurrence previous to operation	Postoperative complications	End results
			Gland	Side						
Mixed tumors										
1	51	M	P	L	35 yrs	III	1-6-27	30 yrs	o	Unknown
2	41	F	P	R	16 yrs	III	11- -27	o	Facial paralysis permanent	No recurrence in 9 yrs
3	43	M	P	R	15 mos	II	1-24-3	o	o	No recurrence in 8 yrs
4	33	F	P	R	9 yrs	III	4-11-28	o	o	No recurrence in 8 yrs
5	17	F	S	R	2 yrs	II	4-30-18	o	o	No recurrence in 8 yrs
6	58	F	P	R	19 yrs	II	1-16-29	o	o	No recurrence in 7 yrs
7	53	F	P	R	41 yrs	III	3-1-29	6 yrs	o	No recurrence in 7 yrs
8	17	F	P	L	13 yrs	III	3-20-29	o	o	No recurrence in 7 yrs
9	34	F	P	L	21 yrs	II	6-10-29	o	o	No recurrence in 7 yrs
10	31	F	S	L	6 yrs	II	6-20-29	o	o	Unknown
11	62	F	S	L	10 yrs	III	9-5-29	o	o	Unknown
12	41	F	P	R	3 mos	II	9-9-29	o	o	No recurrence in 7 yrs
13	43	F	S	L	3 yrs	III	1-15-30	o	Facial paralysis temporary	No recurrence in 7 yrs
14	41	M	S	L	1 mo	II	5-3-30	o	o	Unknown
15	50	F	P	L	6 mos	III	5-9-30	1 yr	o	Recurrence in 3 yrs (carcinoma)
16	44	F	P	R		II	9-29-3	o	o	No recurrence in 6 yrs
17	47	F	S	L	34 yrs	II	10-15-30	o	o	No recurrence in 4 yrs
18	35	M	P	L	16 yrs	III	11-21-30	13 yrs	o	No recurrence in 5 yrs
19	33	M	P	L	4 mos	II	1-21-31	o	o	No recurrence in 5 yrs
20	47	F	P	R	3 yrs	II	4-24-31	o	o	No recurrence in 4 yrs
21	40	M	P	L	15 yrs	III	5-13-31	o	o	No recurrence in 5 yrs
22	41	F	S	L	5 yrs	III	6-20-31	o	o	Unknown
23	60	F	P	L	5 yrs	II	10-17-31	o	o	No recurrence in 3 yrs
24	45	F	P	R	1 yr	II	10-3-32	o	o	Recurrence in 3 yrs (fix) with anoma of lip
25	60	F	S	R		II	10-4-3	o	o	Recurred in 3 wks
26	38	F	P	L	1 yr	II	3-27-33	o	o	No recurrence in 3 yrs
27	62	F	P	R		II	3-9-33	o	o	No recurrence in 3 yrs
28	18	M	P	L	4 yrs	I	4-18-33	o	o	No recurrence in 3 yrs
29	33	M	P	L	6 yrs	II	4-24-33	o	Facial paralysis temporary	No recurrence in 3 yrs
30	59	F	P	R	9 yrs	II	7-0-33	o	o	No recurrence in 3 yrs
31	6	F	P	L		III	4-17-34	o	o	No recurrence in 3 yrs
32	37	F	P	L	17 yrs	III	5-12-34	5 d 24 yrs	Facial paralysis permanent	No recurrence in 3 yrs
33	31	F	P	R	15 yrs	III	6-0-34	6 yrs	Facial paralysis permanent	No recurrence in 3 yrs
34	46	F	P	R	6 yrs	III	8-8-34	6 yrs	Facial paralysis permanent	No recurrence in 3 yrs
35	47	F	P	L	5 yrs	II	9-3-34	o	Facial paralysis temporary	No recurrence in 3 yrs
36	59	F	P	R	5 yrs	III	7-5-35	o	o	No recurrence in 3 yrs
37	33	F	P	R	4 yrs	III	7-8-35	o	o	No recurrence in 3 yrs

tioned, the facial nerve was sacrificed in 3 cases. This chronic inflammatory process almost invariably occurs in the parotid gland. Occasionally, a history of an intermittent swelling of the gland may be obtained. Frequently the process is bilateral and as previously mentioned, this occurred in 2 of our 7 cases. At operation a diffuse process involving the entire gland is found, with no demarcation of normal tissue of the parotid gland as in the case of the mixed tumor. If regional nodes are present, they may suggest the inflammatory nature of this process. However, in our series, palpable nodes were not found in any of the cases.

As we have previously stated, the differentiation of this chronic, benign inflammatory process from malignancy has been difficult. We believe, however, that with a greater appreciation of its frequency, when at operation diffuse processes are encountered involving the entire parotid gland, biopsy may be of aid. At times the differentiation microscopically between these inflammatory lesions and malignancy of these glands will be difficult without an extensive experience in the microscopic diagnosis of these tumors.

There were 9 malignant tumors in this group and all were found in the parotid gland. The criteria for malignancy in the case of salivary gland tumors are difficult to establish because of the divergent histological picture. The mixed tumor often lacks differentiation of various of its cells, and there may be poor encapsulation. It would be futile to classify as malignant all those tumors that show evidence of capsule invasion. We have considered only those tumors malignant in which there were combined cellular anaplasia or metaplasia, invasive properties, and evidence of rapid growth which would warrant making a diagnosis of malignancy in whatever tissue these changes might make their appearance. Invasive growth alone, although ordinarily a helpful diagnostic point in the case of malignant tumors, is valueless in the group of salivary gland tumors.

We have never seen a mixed tumor of the parotid gland metastasize as such. Rather, the same situation occurs as that encountered in the case of teratomas of the testis or ovary,

in which some one element undergoes malignant change and metastasizes as a specific cell type, so that it would be impossible to hypothecate from the metastasis alone the teratoid nature of the tumor. On this basis there were 9 cases of malignancy; 1 low grade papillary adenocarcinoma, 4 epidermoid carcinomas, 2 of grade II, and 1 each of grades I and III; 3 undifferentiated carcinomas, and 1 fibrosarcoma developing from a mixed tumor.

Case 15 is of considerable interest. The first specimen of this tumor showed a characteristic mixed tumor with myxomatous stroma but no evidence of malignancy. A year and a half after removal, recurrence took place which appeared as a relatively undifferentiated tumor of somewhat uncertain cell type. The diagnosis was originally in question, but it was probably a carcinoma in spite of the fusiform character of many of the cells. In spite of intensive roentgen-ray treatment, death resulted a year and a half later.

In contrast to this is Case 72. Only fairly well developed fibroblasts with numerous mitotic figures were found in the tumor at the first operation. Since this tumor had been present for 3 years it is probable that it originated in a mixed tumor of the parotid gland, although there was no definite evidence of the existence of a mixed tumor at the time of operation. Three years later the metastatic lesion in the liver showed it to be a definite fibrosarcoma, essentially similar in histological appearance to the first specimen obtained from the parotid gland.

Eight of the 9 patients with malignant tumors were women. The average age, 59.8 years, is considerably greater than the average age of the patients who had mixed tumors (44 years), although apparently they may occur at nearly any age. In our group the patients varied from 36 to 78 years. The average duration of these tumors was also much less than the duration in the mixed tumor group, being 3.6 years as compared to 10.7 years in the latter. In 4 of the malignant cases, swelling had been present for less than 1 year but 1 patient had been aware of a tumor for 20 years. The majority of the malignant tumors are of short duration and rapidly growing but they may be slow growing tu-

TABLE I—SALIVARY GLAND TUMORS—Concluded

Case	Age years	Sex	Location		Duration	Size	Date of operation	Recurred previous to operation	Postoperative complications	End results
			Gland	Side						
Epidermoid carcinoma II										
66	78	F	P	L	2 yr	III	4-22-31	0	Facial paralysis permanent	Died in 1 1/2 yrs. (recurrence local and metastatic)
67	36	F	P	L	5 yrs	III	11-27-31	0	Facial paralysis permanent	No recurrence in 4 yrs
Epidermoid carcinoma III										
68	60	F	P	R	20 yrs	III	9-27-34	0	0	No recurrence in 1 yr
Carcinoma undifferentiated										
69†	39	F	P	L	6 mos	III	12-19-31	2 yr	Facial paralysis permanent	Died in 3 yrs (recurrence with metastasis)
70†	71	M	P	R	6 mos	III	10-30-34	0	Facial paralysis permanent	Died in 2 yrs (recurrence with metastasis)
71†	49	F	P	R	1 mo	III	7-6-34	0	Facial paralysis permanent	Died in 1 yr (recurrence with metastasis)
Fibrosarcoma										
72	55	F	P	L	3 yrs	III	7-19-30	3 yrs	0	Died in 5 yrs. (metastasis to liver)
Adenoma										
73	76	M	P	R	1 yr	III	10-2-34	0	0	No recurrence in 2 yrs
74	63	F	P	L	10 yrs	III	10-26-36	0	0	No recurrence in 1 yr
Chronic inflammation										
75	46	F	P	Both	8 yrs	IV	7-7-26	0	Facial paralysis permanent	No recurrence in 6 yrs
76	46	F	P	Both	6 mos	III	12-14-31	0	Facial paralysis temporary	No recurrence in 6 yrs
77	64	F	P	R	1 wk	II	1-3-31	0	0	No recurrence in 2 yrs
78	46	F	P	R	2 yrs	II	4-16-31	0	0	No recurrence in 1 yr
79	60	F	P	L	?	III	6-30-31	Apparently 1 yr	Facial paralysis permanent	No recurrence in 4 yrs
80	71	F	P	R	2 mo	II	7-7-31	0	0	No recurrence in 4 yrs
81	66	F	P	R	6 mos	IV	5-6-34	0	Facial paralysis permanent	No recurrence in 1 yr

*Parotid

†Submandibular

‡Roentgen-ray treatment, III

§Roentgen-ray treatment, II

||Roentgen-ray treatment, IV

Inflammatory lesions of the parotid gland are frequently associated with calculi in the ducts or obstruction of Stensen's duct from other causes. This group of cases, however, is noteworthy in that no calculi were demonstrable in the ducts of the gland; the ducts were patent to probing and in certain instances to

the injection of lipiodol (5) (Figs 7, 8 and 9). As will be seen from the clinical data this rapidly developing process in patients of advanced years has been difficult to differentiate before operation from the malignant tumors. Radical operations were done in the majority of the 8 cases and, as has been previously men-

SUMMARY

1 Eighty-one tumors of salivary gland origin are reported

2. From this series of cases the incidence is definitely in favor of the embryologic misplacement of cells as the mode of origin of most salivary gland neoplasms

3 The extremely variable histological appearance of the mixed tumors is discussed and clinical data of the 51 mixed tumors are presented

4 The incidence of recurrence of the mixed tumors following operation at the clinic is 43 per cent

5 Papillary adenocystoma, cysts, the rare adenocystoma lymphomatosum, and the uncommon adenomas are discussed

6 Our criteria for diagnosis of malignant tumors of the salivary gland are presented and the cases of 9 patients, 3 of whom are alive and well at the present time, are reported

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mors All of the malignant tumors in our series were 7.5 by 5.5 centimeters or larger at the time of operation

The only patient in our series with papillary adenocarcinoma was apparently cured but died at the end of 5 years with a carcinoma of the cervix One patient with epidermoid carcinoma, grade I, and 1 with an epidermoid carcinoma, grade II, are alive and well 2 and 4 years respectively, after operation One patient who had had an epidermoid carcinoma, grade III, removed was alive and well at the end of 2 years All of the patients who had an undifferentiated carcinoma and the patient with fibrosarcoma were dead within 3 years after operation Radical excision was done in this group of cases as shown by the fact that the facial nerve was sacrificed in 6 of the 9 patients Supplementary roentgen or radium therapy, after operation was employed in 4 of the cases Two of the 9 malignant tumors had been excised previously and had recurred before the patient came to the clinic

It has been the policy in this clinic to advise excision of tumors of the salivary gland, particularly tumors that are increasing in size McFarland (9) has emphasized the high incidence of recurrence in the mixed tumor group following operation on small tumors Our experience with the small salivary gland tumors has been so limited that we cannot comment on this attitude Complete excision of tumors without leaving particles of tumor tissue behind has frequently, in our experience been more difficult technically in the small than in the large tumors, and this may be the explanation for the reported high incidence of recurrence in the smaller salivary gland tumors Too much emphasis cannot be placed on the importance of careful complete excision of these tumors without rupture of the capsule when present, and spilling of the tumor contents Fortunately the majority of these tumors lie above the main branches of the facial nerve but, as we have previously stated when malignancy is suspected and it is impossible to remove the tumor entirely without sacrificing the nerve this should be done Complete and permanent paralysis of the facial nerve has in the past been a very disturbing deformity and the various plastic procedures

that have been developed for its correction have not been particularly successful Recently, anastomosis of the spinal accessory nerve and the hypoglossal nerve to the peripheral end of the facial nerve and resection of the superior cervical sympathetic ganglion have offered promising results If at the time of operation a diffuse process involving the entire gland is found, if there is a history of intermittent swelling of the tumor, or if it is bilateral, before the facial nerve is sacrificed the presence of an inflammatory process should be suspected and biopsy should be performed, with careful microscopic study by a pathologist who has had considerable experience in the diagnosis of salivary gland tumors

The effect of roentgen rays and radium in our group of patients has not been encouraging with the exception of the one case in which mandibular invasion had occurred We fully realize, however that in the past the dosage given probably was inadequate, and we hope in the future that with increasing experience with roentgen ray and radium therapy, the results may be improved The continuation of large doses of deep roentgen rays supplementary to radical excision in patients with malignant tumors should be continued until it is definitely proved that such treatment is of no value

In the benign tumors of salivary gland origin with careful complete excision, we believe that the incidence of recurrence will not be high However the fact that these tumors may recur many years after operation must be realized We do not agree with the premise that the outlook for patients with malignant tumors of the parotid gland is hopeless With improved diagnostic criteria, with radical excision, and with improved roentgen ray therapy better end results may be anticipated It must be remembered that it may be necessary to sacrifice the facial nerve in many of these patients if a cure is to be obtained It has always been the policy in this clinic to explain carefully to patients with parotid tumors of any type previous to operation that facial paralysis may result after operation if the tumor is so extensive that it is impossible for it to be removed without causing injury to the nerve

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THE ACUTE SAFETY OF ETHER, DIVINYL ETHER, AND CHLOROFORM IN THE PRODUCTION OF THE "OBSTETRIC DEGREE" OF ANALGESIA

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IT is a most remarkable circumstance that, after 90 years of constant progress in chemistry and pharmacology, ether still remains our safest and most generally useful anesthetic. None of its newer rivals is capable of entirely replacing it. Even in those clinics in which the preference is given to some other anesthetic ether is usually held in reserve for those more or less frequent instances in which the favored agent fails to provide satisfactory anesthesia.

There is no doubt, however, that the action of ether leaves much to be desired. Particularly objectionable are the discomfort it causes the patient and its injurious effects upon the metabolism, kidney function, and respiratory epithelium. Most of the substitutes for ether which are now in use owe their vogue to their alleged superiority on one or more of these points.

For the reasons just given, we must welcome the introduction of a new anesthetic agent, but such an agent ought to be subjected to a most searching experimental and clinical study before it is finally accepted as superior to our present anesthetics. The high degree of efficiency of the agents now in use make such an evaluation a complex and difficult problem. It is a task which cannot be done hurriedly.

We were led to undertake the following studies by the report of Knoefel, Guedel and Leake 1931 that divinylether or "vinethene" ($\text{CH}_2\text{CHOCHCH}_2$) showed great promise of qualifying as a useful general anesthetic. We were especially interested in the claim that anesthesia was induced rapidly and pleasantly and was not followed by nausea. It is obvious that an anesthetic having these properties

might be of great value in obstetrics. The drug has already attained a certain vogue for this purpose (2, 3).

In the experiments we are reporting, we have been concerned with the determination on dogs, of the acute safety of vinethene analgesia under the conditions obtaining in obstetrics, dentistry, and minor surgery, and its comparison with that of the older agents, chloroform and ether. We have included, in addition to the conventional determination of the so called margin of safety as expressed by the percentile relationship of the lethal to the effective dose, a statistical study of resuscitation from an overdose of these various agents.

TECHNIQUE OF THE DETERMINATION OF THE SAFETY OF AN ANESTHETIC

The acute safety of an anesthetic may be studied upon both human and laboratory material.

1 Clinical determination. The clinical determination of the acute safety consists chiefly in a statistical study of the anesthetic mortality in a series of administrations. This is by no means as simple a procedure as one might expect. In fact an analysis of the various published statistics shows a marked lack of agreement in the percentage mortality attributed to even our oldest anesthetics, although our experience with these now covers many millions of administrations. The reader, therefore who sets out to make a comparison of the clinical mortality from the use of a new anesthetic with that from one of the older anesthetics is up against an extremely difficult if not impossible task. This very unsatisfactory state of affairs may be expected to continue until detailed reports of all anesthetic fatalities are compulsory and a standardized definition of the term 'anesthetic death' is adopted by all workers in this field.

From the Department of Physiology and Pharmacology
University of Colorado School of Medicine
Vinethene supplied by Merck and Company

Our own guess (and it is only a guess) is that the mortality of ether anesthesia is somewhere between 12,000 and 13,000. This is considerably higher than is indicated by most statistics, such as those quoted by Sollman, which range from 15,100 to 123,200 and average 116,000, but is, on the other hand, considerably lower than certain of the recent compilations such as those of Bartlett and Simmons, 1932, who encountered an acute ether mortality of 1738 in the course of 10,325 gynecologic abdominal operations upon good risk patients and of Rollison, 1930, who reported a mortality of 11,010 in 6,062 general anesthetics of various types. It is quite evident, therefore, that the published statistics of anesthetic mortality do not provide a sound basis for the comparative clinical evaluation of a new drug.

If, as a basis for discussion, we take 13,000 as the expected mortality in ether anesthesia, it is at once apparent that we have in ether an agent which, in spite of its admitted defects, is none the less a remarkably safe anesthetic. Certainly, we are not justified in lightly abandoning it in favor of some new substance which has had as yet only the most superficial investigation.

A great deal of unnecessary confusion would be avoided if investigators sufficiently realized that statistical studies of anesthetic mortality require data from a very large series of administrations. The dangerous fallacy of attempting to determine an "average" from an inadequate series is well known to all bio-assayists. We believe that this same principle applies with equal force to the closely related field of mortality statistics in anesthesia. That this obvious fact is not widely appreciated is sufficiently illustrated by the numerous prematurely enthusiastic reports which have accompanied the introduction of so many of the new anesthetics.

2 *Laboratory determination* The laboratory worker enjoys a great advantage over the clinical observer in that he can deliberately induce death in his experimental animal under a standardized set of conditions. He is thus enabled to observe at will, under controlled conditions, the effects of measured toxic doses of an anesthetic. Data of this type are im-

possible to obtain under clinical conditions. It should, however, never be forgotten that information obtained from laboratory animals is valid only for that particular species and that, although such information may serve as a useful clinical guide, it cannot take the place of prolonged and accurate clinical observation.

As the following brief exposition will show, the members of the inhalation group of anesthetics have in common certain pharmacological peculiarities which make the investigation of their margin of safety more difficult than a similar study upon non-volatile anesthetics. Fortunately for the investigator working with this latter group of drugs, the methods of administration usually employed, particularly the intravenous, preclude any serious irregularities in the rate of absorption. Therefore, ordinarily it may be assumed that the amount of the drug entering the animal's blood stream is identical with the amount administered. Furthermore, the rate of detoxification and excretion of these drugs is usually so slow, compared with the rate of absorption, that it also may be assumed that the amount of the drug retained within the animal, i.e., the amount responsible for the narcosis is, for all practical purposes, identical with the amount administered. This definite relationship existing between the amount of a non-volatile anesthetic which is administered and the degree of the narcosis which subsequently develops greatly simplifies the task of the investigator.

With the members of the group of volatile anesthetics, however, the experimental conditions are quite different. These drugs are necessarily administered in the gaseous state and the amount entering the blood stream is, therefore, not easily ascertained. The excretion of these substances, in contrast to that of the members of the non-volatile group, is so rapid that, unless special precautions are taken, the amount retained in the animal, i.e., the amount actually responsible for the narcosis, bears only an indirect relationship to the amount administered.

The peculiar experimental conditions noted have compelled most of the previous investigators to direct their studies to the relation-

ship which they have supposed to exist between the concentration of the anesthetic in the inspired air, blood, and tissues, and the depth of narcosis. But, in the belief of Haggard, no such relationship exists until after full equilibrium has been established because, "Only at full equilibrium for any tension of ether inhaled can the physiological state (narcosis) be correctly correlated with the inspired or expired ether concentration or with that of the blood drawn from any source" (6). As reference to the following authorities will show there are substantial reasons for doubting that these equilibria are ever reached during the relatively short period of clinical anesthesia (7, 10). These equilibrium relationships, consequently, are complex and partake of the nature of a curve the shape of which is determined in part by the involved time factor. It follows from these considerations that the margin of safety of a given inhalation anesthetic may vary significantly with the duration of the anesthesia (7). Since most of the margins of safety found in the literature have been calculated from data obtained during very prolonged administrations they cannot be considered as necessarily measuring the safety of an anesthetic when used for very brief periods. It is obvious that experiments designed to make this determination with particular reference to obstetrics, dentistry, and minor surgery, should involve anesthetics which are comparably brief. But as far as we have been able to ascertain none of the published studies has been so planned and their significance for these specialized fields is therefore questionable.

DESCRIPTION OF EXPERIMENTAL PROCEDURE

Our primary object has been to determine the relative acute safety of ether, chloroform and divinyl ether when used to produce the degree of analgesia required in obstetrics, dentistry, and minor surgery. Since the determination of the margin of safety of an anesthetic is, in essence, a biological assay it should be conducted as far as possible in accordance with the established principles governing this procedure. We have therefore tried to plan our experiments to conform with the more important of these principles. Among such are

1. *Number and character of the individuals making up the series.* To the bio-assayist an adequate series is one which is numerically large enough to furnish a median dose which would not be significantly changed by the addition to the series of data from any number of other individuals. The exact number of animals thus required for an adequate series is an individual matter for each drug and can be determined only after a study of the curve of response of a large population to that drug. Since a series of this magnitude for each of the three anesthetics was from considerations of time and expense, beyond our resources, we are presenting, for each drug data derived from only 35 dogs. Experience, however, has shown that a series of this size is adequate for the bio assay of most drugs. A larger series would have necessitated the use of smaller animals such as mice or rats. In our opinion the greater physiological resemblance existing between dogs and men together with the greater ease of individualizing experiments upon dogs more than compensates for the loss in the number of individuals which the use of these animals has necessarily entailed. Mongrel dogs in good health kept on a diet of Purina Chow were used. Of these approximately two thirds were males.

2. *The experimental technique employed should be so standardized as to make possible a direct comparison between the data from any one experiment, animal or drug with that from any other experiment, animal or drug in the series.* The importance of employing a rigidly standardized technique in all the experiments of a series of this character cannot be overemphasized. This is a fundamental principle of biological assay and indeed, it is not too much to affirm that in its absence no assay has been accomplished and that therefore, the toxicity of the drug in question has not been determined. Haphazard experimentation is responsible for much of the confusion which exists in pharmacology today and perhaps in no field is this more evident than in that of the inhalation anesthetics. Most of the experiments found in the literature upon the margin of safety of the various inhalation anesthetics are of this haphazard nature and consequently they do not provide a very sound ground for the

determination of their comparative merits, nor do they serve as a satisfactory basis for the evaluation of a proposed new anesthetic.

In an attempt to meet this obvious objection to much of the older work we have conducted all of our experiments according to the following routine

Figure 1 is a diagrammatic sketch of the apparatus employed. It is essentially a closed soda-lime absorption system within which the anesthetic is volatilized in an atmosphere of oxygen. The use in this way of the Waters technique has enabled us to keep the dead space of the apparatus to within 5 to 6 liters and to imitate this popular clinical method closely in our experiments. The metal mask contains a rubber diaphragm through which, by means of a syringe and needle, the measured dose of the anesthetic is injected on to a wire screen for volatilization. The mask is fitted tightly to the dog's muzzle by means of a rubber face piece. Every effort is made to prevent gas leakage at this point and the entire system is tested frequently for leaks. Since the screen is warmed by the animal's exhalations, volatilization of the anesthetic is extremely rapid and the drug develops its maximum effects within an average period of 2 minutes. The interior of the mask is examined frequently at the end of experiments in order to determine the completeness of volatilization. At no time did we find more than 6 per cent of the administered drug remaining unvolatilized. In these cases the non-volatilization was due to the solution of a portion of the drug in the saliva secreted into the mask. The presence of an excess of oxygen precluded the possibility of asphyxia playing any part in the analgesia.

Each dog was subjected to two series of experiments with each of the 3 anesthetics. In the first series the minimal dose for analgesia (M D A) was determined. This was taken as the smallest dose which produced insensitivity, during at least two out of three successive experiments, to a strong, faradic, electrical stimulus applied to the skin of the lower abdomen. The stimulus was furnished by an inductorium kept at a constant setting throughout the entire series. The degree of anesthesia thus secured was somewhat more profound

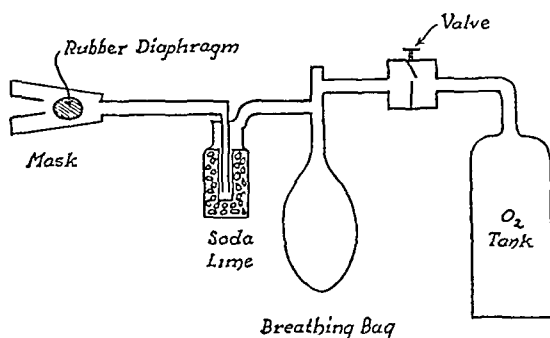


Fig 1 Diagrammatic sketch of apparatus used

than is ordinarily required during the first part of the second stage of labor but, of course, was very much lighter than ordinary surgical anesthesia. The initial dose of the anesthetic administered to an animal was usually somewhat smaller than the average required for analgesia. Successive doses were then varied from the preceding by 10 per cent. We mean, therefore, by the minimal dose for analgesia, the amount of the drug which produced analgesia in at least 2 of 3 consecutive experiments and which, when reduced by 10 per cent, produced analgesia in not more than 1 of 3 consecutive experiments. Consequently, the establishment of the minimal dose for analgesia for any given animal was not the result of a single experiment, but was repeatedly confirmed by the use of doses 10 per cent both above and below this figure. It follows from the above that the further the minimal dose for analgesia of a particular animal diverged from the median, the more thoroughly was this figure established by means of repeated experiment.

In the second series of experiments, the minimal dose of each drug required to produce an apparently permanent respiratory arrest (M D R A) was established. For this purpose the initial dose employed was usually below the average. It was then increased or decreased by 10 per cent as required, until we had determined an amount of the drug which produced an apparently permanent respiratory arrest and which when reduced by 10 per cent failed to cause arrest. After the respiratory paralysis had lasted 15 to 20 seconds, the mask was removed and the animal was

resuscitated by artificial respiration and the administration of oxygen. In order to save the animal as much anesthesia as possible, a single respiratory arrest was taken as the end point of these experiments. In the case, however, of a minimal dose for respiratory arrest which diverged greatly from the median, the use of doses varying by only 10 per cent served repeatedly to confirm the unusual response of the animal. A period of from 2 to 3 days intervened between experiments on individual dogs.

The use of the same dog for a succession of anesthetics obviously raises the question of tolerance. For the following reasons we do not believe that the development of tolerance complicates our results to a significant degree. (a) In order to avoid weighting of the series by any possible cross tolerance, the animals were roughly divided into three groups each of which began the series with a different anesthetic. (b) In a number of animals the experiments were interrupted for periods of one month or more. Upon resumption of the experiments no constant change was seen in their susceptibility. (c) Finally it is scarcely conceivable that a series of anesthetics, amounting in sum to the equivalent of only 60 minutes of ordinary anesthesia could, when spread over a period of 3 months, result in an important degree of tolerance.

With the technique we have described an undetermined part of the administered dose remained unabsorbed from the dead space of the apparatus. Therefore, that part of the administered dose which remained unabsorbed at the conclusion of the experiment should be deducted from our figures in order to arrive at the actual amount of the drug acting. To have obtained this information would have required an analysis of the contents of the dead space at the conclusion of each of the 103 experiments. If we had attempted this laborious procedure we would necessarily have been compelled to reduce the number of experiments and, whatever advantage the series might have gained in accuracy, would have been nullified by a reduction in the number of individuals.

3. *The personal element in work of this character is very great. For this reason the bio assay*

is accustomed to carry out his own "control experiments concurrently with each assay series."

Experience has shown that, even when the same technique is used, the experimental results obtained by different workers may vary considerably. Consequently, whenever a determination of the comparative toxicity of two drugs is attempted, the chances of error are increased unless both of the drugs are studied by the same investigator and by the same technique.

As a general rule the workers who have studied the toxicity of the inhalation anesthetics have not standardized their individual experiments and unfortunately, have limited themselves to the investigation of only one drug. This, together with the confusion resulting from the use by one worker of a technique which differs in essentials from that of other workers, gives the available data in this field such a heterogeneous character that it is difficult to use them as a basis for the comparative evaluation of two or more anesthetics.

In order to facilitate such a comparison we have added to our investigation of divinyl ether a similar study, by the same technique, of the older anesthetics, ether and chloroform.

4. *It is desirable that the experiments be planned whenever possible, to yield data in terms of a measured amount of the drug per unit weight of animal.* It has been the almost universal custom for those investigating the margin of safety of the non volatile anesthetics to report their findings in terms of a measured dose of the drug per unit of body weight and for those investigating the inhalation anesthetics to report in terms of the volumes per cent in the inspired air which have been allowed to act over varying periods of time, etc. A direct comparison of the accuracy of safety of the various inhalation anesthetics with those of the non volatile group for this reason cannot be made on the basis of the published data. In view of the fact that the anesthetist is often called upon to choose between these two types of anesthetic agents, this comparison would seem to be highly desirable. Quite aside from the above consideration there seems to be little doubt that, when the quantity of the drug acting is expressed in terms of the measured amount per unit of

TABLE I.—COMPARATIVE POTENCIES AND MARGINS OF SAFETY

	Potency	Margin of safety
Ether	100	100
Divinyl ether	186	70
Chloroform	722	63

body weight, it is more readily understood by most laboratory workers and clinicians than when expressed as volumes per cent, etc

5 *An assay of the acute toxicity of an inhalation anesthetic should also include a systematic study of the ease and certainty of resuscitation from an overdose* Although studies on this aspect of the toxicity of drugs are not a usual part of biological assays, it is obvious that the information so obtained would be of practical value Its importance, in the case of the inhalation anesthetics, has already been briefly discussed As a general rule, a patient can be more readily resuscitated from an accidental overdose of one of the inhalation anesthetics than from a similar overdose of a non-volatile anesthetic This important property of the volatile anesthetics makes these drugs much safer in practice than a mere consideration of their margin of safety would indicate

DISCUSSION OF RESULTS

Our experimental results, after giving to ether the arbitrary value of 100, are briefly summarized in Table I This table shows that chloroform has the highest potency but the lowest margin of safety and that ether, the least potent of the 3 has the highest margin of safety. Divinyl ether occupies an intermediate position with respect to both these properties

From Table II it may be seen that our animals exhibited a quite considerable variation in susceptibility to all three of these drugs The margin of safety was calculated from the

formula $\frac{\text{M D R A} - \text{M D A}}{\text{M D A}}$ expressed as per

M D A, minimal dose for analgesia
M D R A, minimal dose for arrest of respiration

cent Dosage is given in cubic centimeters per kilogram of body weight

A spread of the magnitude we have encountered, between the least and most susceptible of the series, may be explained as being (1) only apparent and due, therefore, to errors in technique, or (2) as reflecting an actual varia-

TABLE II —SUSCEPTIBILITY TO DRUGS

		Ether	Divinyl	Chloroform
Experiments		389	339	375
M D A	minimum	0.39	0.19	0.058
	maximum	1.10	0.46	0.132
	median	0.65	0.35	0.090
M D R A	minimum	1.00	0.50	0.110
	maximum	3.30	1.05	0.255
	median	1.65	0.70	0.175
Margin of safety	minimum	64%	39%	31%
	maximum	340%	284%	219%
	median	144%	100%	90%

Total experiments in series, 1,103
M D A, minimal dose for analgesia
M D R A, minimal dose for arrest of respiration

TABLE III —MINIMAL DOSE

Analgesia			Respiratory arrest		
Dog A M, female, weight 6.75 kilograms Anesthetic, divinyl ether			Dog A I, male, weight 8.1 kilograms Anesthetic, divinyl ether		
Dosage in c cm per kilogram (median dose of series is 0.35)			Dosage in c cm per kilogram (median dose of series is 0.70)		
Exp No			Exp No		
1	0.30	Analgesia	1	0.72	Respiratory arrest
2	0.30	Analgesia	2	0.63	Respiratory arrest
3	0.27	Analgesia	3	0.56	Respiratory arrest
4	0.27	Analgesia	4	0.50*	Respiratory arrest
5	0.24	Analgesia	5	0.45	Non-arrest
6	0.24	Analgesia			
7	0.24	Analgesia			
8	0.215	Analgesia			
9	0.215	Analgesia			
10	0.19*	Analgesia			
11	0.19*	Analgesia			
12	0.17	Incomplete			
13	0.17	Incomplete			
14	0.17	Incomplete			

*Lowest doses encountered in the divinyl ether series

tion in susceptibility. A certain degree of error is inherent in work of this character, but as we have mentioned above, it follows as a consequence of the technique we have employed, i.e., the use of repeated doses varying by only 10 per cent, that the further the response of an animal diverged from the median, the more frequently was the response confirmed Therefore, it is just those abnormal responses, which might be taken as pointing to

TABLE IV — CORRESPONDENCE OF DOSES

	M D A in c cm/kgm			M D R A in c cm/kgm		
	Aver age	Me dian	Diffe ence	Aver age	Me dian	Diffe ence
Ether	0 67	0 65	3 1 st	1 75	1 65	4 8 th
Divinyl eth r	0 35	0 35	5 7 th	0 69	0 70	1 4 th
Chloroform	0 005	0 000	1 2 nd	0 155	0 215	1 2 nd

errors in technique, which have been the most carefully established. This will be made clear by reference to Table III in which the experiments establishing the lowest values obtained for the minimal dose of divinyl ether for analgesia and minimal dose for respiratory arrest are presented in detail.

To a very limited extent the accuracy of an assay may be inferred from the tendency toward coincidence of the average dose of the whole series and the median or amount effective in 50 per cent of the animals (12). The extent to which these doses correspond in our series is shown in Table IV.

Graphs constructed from the data obtained from each of these three drugs all show the S shaped curve regarded as characteristic of drug toxicity determinations. They are not reproduced here because of space limitations. Fairly steep symmetrical curves were obtained with both chloroform and divinyl ether. The ether curves, however, reveal a relatively greater degree of skew. This may be taken as indicating that of the three drugs ether is probably the least predictable and is therefore the least reliable when administered by methods involving predetermined dosage. The greater margin of safety of ether, however, undoubtedly more than compensates for this disadvantage.

Although the individual variation in the response observed in our dogs is large, it is probably no greater than has very often been encountered during similar studies in both animals and man. Even when all these precautions (ancestry age, diet, weight, and sex) are taken animals still show a wide variation in their response to drugs. Clark, 1937, Poe, Suchy, and Witt, 1936, who measured the lethal dose of strychnine base for 4,000 rats found that in the case of adult male rats the mean lethal dose was 2.25 milligrams per kilo-

gram. However, 1 in 25 of their rats was killed by 1.5 milligrams per kilogram and a similar number survived 3.5 milligrams per kilogram. McCollum, 1930, found that the anesthetic concentration of chloroform varied in 5 dogs from 19 to 38 milligrams per 100 cubic centimeters of blood. In the case of evipal, McNelis, 1936, found that in 1,000 cases, one man required 4 grams to produce anesthesia and that, with one woman, 0.9 gram appeared to be an overdose. Working with divinyl ether, Goldschmidt and associates, 1934, found that the anesthetic concentration in 8 human subjects varied from 11.3 to 22.8 milligrams per 100 cubic centimeters of blood and that, in 20 dogs, this concentration ranged from 18 to 47 milligrams per 100 cubic centimeters of blood. These few examples selected at random from the literature illustrate the well established principle that an individual variation in the response to all drugs is inherent in all biological material. Therefore, although extensive studies may establish beyond doubt the response of the average of a population, that of any of its individual components must always remain unpredictable and instances of extreme susceptibility, often erroneously ascribed to idiosyncrasy, are mathematically certain to occur in every large series of drug administrations. The anesthetics are certainly no exception to this rule and the conclusion is inescapable that the production of a uniform response such as surgical anesthesia is safe only in so far as the dose is adjusted to the susceptibility of the individual. The inhalation method of anesthesia therefore must be regarded as fundamentally safer than the method of predetermined dosage.

It is self evident that an anesthetic death may be regarded as also a failure of resuscitation. If resuscitation from an overdose of an anesthetic were always possible, there need never be an anesthetic death. This is an aspect of the toxicity of anesthetics which appears to have been largely neglected by the previous workers in this field. And yet it is obvious that the margin of safety alone is an inadequate guide to the probable clinical mortality which will accompany the use of a particular anesthetic for the reason that the acute mor-

tality is determined not only by the margin of safety, but also by the ease and certainty of resuscitation from accidental overdose. After all, the margin of safety is concerned only with the likelihood of an overdose. The likelihood of *death*, however, in the event of overdose, depends entirely upon the probability of resuscitation. The ease and the certainty of resuscitation from overdosage are a phase of anesthetic toxicity which depends upon pharmacologic considerations entirely separate from those responsible for the margin of safety and is possessed by the individual anesthetics to a varying degree. In practice it is probably of even greater importance as the determining factor of anesthetic death. This is brought out in Table V which summarizes the data obtained during the resuscitations from 136 instances of overdosage with the three anesthetics. It will be seen that the probability of resuscitation from an overdose of chloroform is very much less than that from both ether and divinyl ether.

The point we have emphasized above, namely, that the margin of safety alone is a quite inadequate guide to the probable clinical mortality, is made clear when the position of divinyl ether with respect to the likelihood of an overdose (Table I) is contrasted with respect to the probability of resuscitation following an overdose (Table V). Although in our hands the margin of safety of chloroform is only 10 per cent below that of divinyl ether, it should, because of its marked inferiority with respect to resuscitability, prove to be much the more dangerous drug.

Our resuscitations from both ether and divinyl ether overdosage have been uniformly successful. There are two points, however, concerning the behavior of our animals after an overdose of these drugs, which deserve some comment. It was noticeable that the animals poisoned with divinyl ether tended to recover more rapidly under artificial respiration than those poisoned with ether. This may be attributed to the relatively rapid elimination of divinyl ether. Rapid elimination of a poison is a most important factor in successful resuscitation and, in this respect, divinyl ether appears to be definitely superior to ether. On the other hand, the circulatory condition of

TABLE V —STUDY OF RESUSCITATION
FROM RESPIRATORY ARREST

	No. of respira- tory arrests	No. of failures to resuscitate	% of failure to resuscitate
Ether	42	0	00
Divinyl ether	45	0	00
Chloroform	49	6	12.2

the animals at the time of respiratory arrest, as judged by the degree of cyanosis, strength of heart beat, etc., appeared to be considerably better following an overdose of ether than of divinyl ether. With respect, therefore, to its circulatory toxicity—a factor of equal importance in resuscitation—divinyl ether appears to be definitely inferior to ether.

If we regard resuscitation from poisoning by an inhalation anesthetic as essentially a race between the elimination of the toxic agent and the development of its fatal effects upon the circulation, it is evident that each of these drugs possesses an important advantage over the other. We are inclined to believe, however, that ether, due to its greater margin of safety, will prove to be the safer of the two drugs. During the course of our experiments it became quite evident that chloroform, with regard to both the rapidity of its elimination and the condition of the circulation at the time of respiratory arrest, was inferior to both ether and divinyl ether. The disastrous effect of a combination of slow elimination and high toxicity to the circulatory system is reflected in the high percentage of failures to resuscitate from chloroform overdosage which is shown in Table V.

There is another aspect of the behavior of our dogs during chloroform poisoning which is of interest. Although, during the course of our experiments, we administered 121 toxic doses of chloroform by a very brusque method—a method which violated all the established principles of safe chloroform administration—we encountered but one instance of primary chloroform collapse. In all of our other experiments the animals proceeded to the condition of bulbar depression or paralysis through the regular sequence of the stages of anesthesia. This is in remarkable contrast to the frequent cardiac collapse encountered when chloroform

TABLE IV — CORRESPONDENCE OF DOSAGES

	M D A in cc cm/kgm			M D R A in cc cm/kgm		
	Aver age	5 e dian	Differ ence	Aver age	Me- dian	Differ ence
Ether	0.67	0.65	3.47	1.73	1.65	4.87
Divinyl ether	0.33	0.35	5.70	0.60	0.70	1.47
Chloroform	0.091	0.090	5.96	0.377	0.375	2.30

errors in technique, which have been the most carefully established. This will be made clear by reference to Table III, in which the experiments establishing the lowest values obtained for the minimal dose of divinyl ether for analgesia and minimal dose for respiratory arrest are presented in detail.

To a very limited extent the accuracy of an assay may be inferred from the tendency toward coincidence of the average dose of the whole series and the median or amount effective in 50 per cent of the animals (12). The extent to which these doses correspond in our series is shown in Table IV.

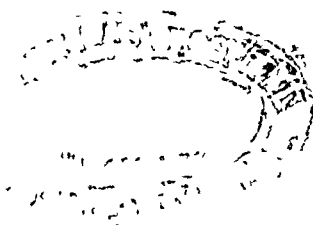
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is very rapidly and carelessly administered to dogs by the conventional drop method. We attribute the relative absence of chloroform collapse in our series to the use of pure oxygen instead of air as a volatilizing medium. Evidently the excess of oxygen served to protect the heart from the usual toxic effects of chloroform.

A few general comments may be made on the response of our animals to these anesthetics. We are unable to confirm the observations of Leake, Knoefel and Guedel, 1933, that less salivation and mucus flow occurs during the administration of divinyl ether than of ether. In our experience divinyl ether produced more salivation and mucus flow than ether. The same authors found that divinyl ether was followed by less postanesthetic nausea and vomiting. Our dogs showed postanesthetic nausea and vomiting so infrequently after all three of these anesthetics that we cannot confirm or deny this statement. We are also unable to agree with their claim that anesthetization with divinyl ether is much smoother than with ether. On the contrary the dogs given divinyl ether showed the most tendency to muscular excitement and not infrequently even mild clonic convulsions occurred during both the induction and recovery stages. The recovery stage, however, seemed to be somewhat shorter after the use of divinyl ether.

We were impressed by the superior smoothness of the analgesia produced by chloroform and it is easy to understand why the use of this drug has persisted in obstetrics in spite of the growing appreciation of its greater toxicity. The smoothness of ether analgesia appeared to be intermediate.

The nutritional effects of a series of anesthetics averaging 32 for each dog are of some significance. In general these repeated anesthetics seemed to be well tolerated so far as could be judged by the animal's appetite, appearance, and body weight. During the series the dogs receiving ether averaged a 3.1 per cent gain in weight; those receiving divinyl ether gained 2.3 per cent; and those receiving chloroform lost 1.3 per cent. Comparatively few respiratory infections were encountered. Whenever such infections occurred the

animals were temporarily or permanently discarded.

SUMMARY AND CONCLUSIONS

1. We have attempted to determine in dogs the margin of safety between the states of an algesia and respiratory arrest produced by ether, divinyl ether, and chloroform. Our aim has been to make our method conform as far as possible, to the established principles governing biological assays. In our hands chloroform had the highest potency but the lowest margin of safety. Ether, the least potent of the three, had the highest margin of safety. Divinyl ether with respect to both these characteristics occupied an intermediate position. Concerning the smoothness of the analgesia, we found that chloroform was the most satisfactory and divinyl ether the least.

2. A considerable variation was found in the response of our individual dogs to all of these drugs. Variation in the response to drugs is apparently inherent in all biological material and, for this reason, we believe that the inhalation method of anesthesia, because it permits greater individualization of dosage, is fundamentally safer than the method of predetermined dosage.

3. Although 121 toxic doses of chloroform were administered by a very brusque method only one instance of primary chloroform collapse was encountered. We attribute this relative absence of primary circulatory collapse to the protective action of a high percentage of oxygen upon the heart.

4. A systematic study of the ease and certainty of resuscitation from respiratory arrest was carried out. Resuscitations from 45 overdoses of divinyl ether and from 42 overdoses of ether were uniformly successful but following 49 overdoses of chloroform there were 6, or 12.2 per cent, failures to resuscitate. The high mortality of chloroform overdosage is attributed to the disastrous combination of a slow elimination and a high toxicity to the circulatory system which complicated the resuscitations.

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In 3 instances, the symptoms developed gradually, as already mentioned, within a number of months following a fall from a considerable height. Although these patients had not experienced any symptoms in the neck, an injury of the cervical spine was suggested clinically by the findings here described. Roentgenograms showed in 1 case traumatic destruction of two cervical intervertebral discs, in the second, fracture of one cervical articular process with forward displacement of the fragment, and in the third, fracture luxation of the third cervical vertebra with narrowing of the adjacent intervertebral spaces.

In 3 other instances, we were able to watch the gradual development of swelling and atrophy. These 3 patients underwent roentgen examination of the cervical spine because of recurrent pain and stiffness in the neck. In the first, the ridges of the right index finger became flattened 9 weeks after the onset of pain in the neck, swelling of the index and middle fingers occurred 2 weeks after this atrophy of the skin had become noticeable, the interosseous muscles became atrophic several months after the swelling had subsided. The second patient felt violent tingling in the right middle finger 7 months after pain in the neck had developed, swelling and atrophy of the skin developed simultaneously, but atrophy of the interosseous muscles was less definite than in the other patients of this series. The third patient had been treated for severe pain in the neck 11 months before the left hand had become weak and swollen. The swelling involved the whole hand, together with very marked atrophy of the skin of the fingers, this somewhat resembled scleroderma, but after the swelling subsided, the skin appeared very thin and loosely attached, there was no rigidity and no thickening of the areas involved.

In all the patients, roentgen examination revealed pronounced narrowing of one or two intervertebral foramina of upper cervical spine. This was confined to the diseased side, the corresponding foramina on other side were either normal in width or definitely wider than those on affected side. A simple device (Fig 1) permits the foramina to be radiographed in identical projection on either side, variations due to different projection are thus excluded.

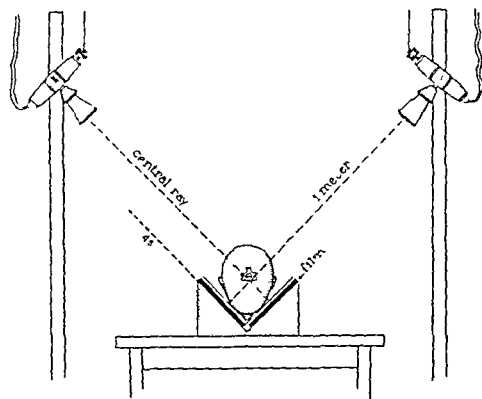


Fig 1 Technique for roentgenographing the cervical intervertebral foramina in identical projection on both sides. The cervical intervertebral foramina are rotated forward, forming an angle of 45 degrees with the sagittal plane. Hence, in order to obtain correct optical sections, roentgenograms must be taken in oblique projection. The head of the patient rests upon a device which consists essentially of two tunnels standing at right angles, each forming an angle of 45 degrees with the horizontal plane. The midline of this device is exactly on the center of a roentgenographic table. Nose and chin of the patient, pointing vertically downward, are in touch with the junction of the tunnels. The tube stand is moved to the end of the table, right for the left foramina, left for the right. Tube stand at 60 centimeters from midline of table and device, tube 80 centimeters above table, anode-film distance 1 meter. These positions are identical for both exposures, merely the tube is rotated inward to an angle of 45 degrees, the central ray being at right angles with the plane of the film. The cervical spine is immobilized by means of immobilization of head and shoulders, deviations from the original position, even when slight, lead by unsymmetrical projection to differences in size and shape of the foramina—a common source of diagnostic errors.

The correlation of the clinical syndrome with the changes in the cervical spine, as found roentgenologically, is shown in accompanying Table I. The results would seem to indicate that

- 1 Swelling and atrophy occur when the foramina above (and including) the fourth cervical are narrowed
- 2 Swelling and atrophy of the hand are independent of the nature of the disease that produces this narrowing
- 3 Rarefaction of the bones of the diseased hand occurs in the presence of swelling and atrophy of the skin, but is independent of atrophy of the interosseous muscles
- 4 There may be no symptoms referred to the neck even in the presence of well marked bony changes of the cervical spine

THE SWOLLEN ATROPHIC HAND

ALBERT OPPENHEIMER M D, Beirut, Syria

THE disease here reported combines swelling with atrophy in one hand. Both atrophy and swelling may vary in degree and, moreover, are not strictly correlated, wherefore the appearance may differ from case to case. Nevertheless, these two signs are always present, and their characteristic contrast is pathognomonic.

Fourteen patients were observed during the past 3 years. The swelling was stated to have appeared "over night" and to have persisted without change for several days or weeks past. Pain "resembling toothache" accompanied it. Two of the patients were referred to us for suspected fracture of the wrist, some slight injury being supposedly related to the symptoms. In 3 other instances, a fall from a height of several meters had preceded the development of swelling by 4, 7 and 8 months respectively. In the 9 remaining patients there was no history of trauma.

The swelling involved the whole hand and wrist in 5 cases, only the wrist, in 2, and one or two fingers in 7 instances. It was resilient, giving the impression of being localized in some deeper layer beneath the epidermis, and it was not confined to the periarticular areas. There was no pitting on pressure. The swollen region did not differ in color from the normal skin. Together with the swelling but sometimes masked by it, there was a variable degree of atrophy of the interosseous muscles of the affected hand, as evinced by increased concavity between the thumb and index finger and by flabbiness of the intervening tissues.

The skin of the fingers was thin and smooth and in 2 instances slightly glossy. The ridges and furrows on the dorsal surfaces of the fingers, especially proximal to the nails, were either less numerous or less prominent than on the normal side. In 5 cases they were entirely absent. The nails were less shiny than on the healthy side and the hairs were less numerous. The atrophic skin was neither ab-

normally dry nor abnormally moist and neither warmer nor cooler than on the normal side. It could not be raised easily from the subjacent tissues, but when the swelling subsided, it appeared thinned and easily pliable. There were no discolored patches, no cracks, no scales, no prominent vessels, and no signs of impaired healing tendency.

The joints were freely movable; there were no signs of arthritis and no manifestations of rheumatic fever.

The reaction of degeneration was definitely present for the muscles of the arm on the affected side in 4 cases, and questionable in 1 case. Sensory disturbances were revealed by the history rather than by objective findings. All the patients had been troubled off and on for periods extending from several weeks to 20 years past, by recurrent "rheumatic" pain in the shoulder girdle or in the deltoid region of the diseased side, by tingling sensations in the finger tips sometimes amounting to violent "electric shocks", by the progressive inability to recognize and to hold between the finger tips some fine or thin object such as a needle or a sheet of paper. Objectively, however, there was neither increased nor diminished sensitivity to mechanical and thermic stimuli. In several cases, besides the interosseous muscles, a group of muscles of the arm was found atrophic. Several patients had experienced definite weakness of the arm on the affected side; 2 of them stated that they often had difficulty in lifting a cup from the table. The grip was weak on the diseased side in all the patients.

In 6 instances roentgen examination showed variable degrees of rarefaction of the bones of the affected hand, either diffuse or confined to circumscribed areas in the metaphyses of the phalanges. Rarefaction was most marked in the carpal bones, where it amounted to almost complete demineralization in 2 instances. Unlike atrophic (proliferative, rheumatoid, infectious) arthritis, the joint spaces were normal in width even in the presence of very pronounced rarefaction.

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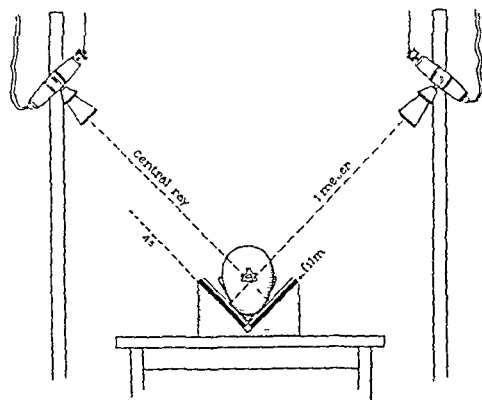


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Fig 2 Case 4 Right fingers swollen, right interosseous muscles atrophic (note excavation between thumb and index finger) Furrows and ridges of the skin not visible on right fingers Roentgenograms arrows point to thorn shaped exostoses at posterior borders of vertebral bodies, foramina narrowed only on right side



Inactivity is not the sole cause of muscular and bony atrophy. Lesions of the cervical or lumbar vertebræ have caused atrophy of the muscles of an arm or leg, but the bones, despite disuse, appeared normal on roentgenograms more than a year after onset of disability. On the other hand, 5 years after acute "sciatica," severe and persistent atrophy of the muscles of one leg was noted. In complete absence of pain, the muscles did not regain normal strength and volume in spite of regular use.

DIFFERENTIAL DIAGNOSIS

Swelling is not very common in neuritis. If present, it is described as being accompanied by vascular disturbances, by discoloration, and by hyperesthesia or analgesia of the skin, as, for example, in causalgia, glossy skin, and allied conditions. In our cases, on the contrary, none of these changes occurred.

From scleroderma, the condition differs by the complete absence of the characteristic thickening and retraction. Bony rarefaction, in scleroderma, is strictly confined to the terminal phalanges where the skin lesion is most pronounced; while in our patients, rarefaction was diffuse and not confined to the areas in which the skin was atrophic. With senile and idiopathic atrophy of the skin the condition has nothing in common, and from acrodermatitis atrophicans (Herxheimer), it differs by the absence of redness, of wrinkling, of prominence of veins, and of symmetrical or systemic involvement, and by the presence of subjective symptoms. From the atrophy of the skin and muscles, a condition that is sometimes associated with chronic atrophic arthritis, the lesion is easily distinguished by the entire absence of any arthritic manifestations in the hand.

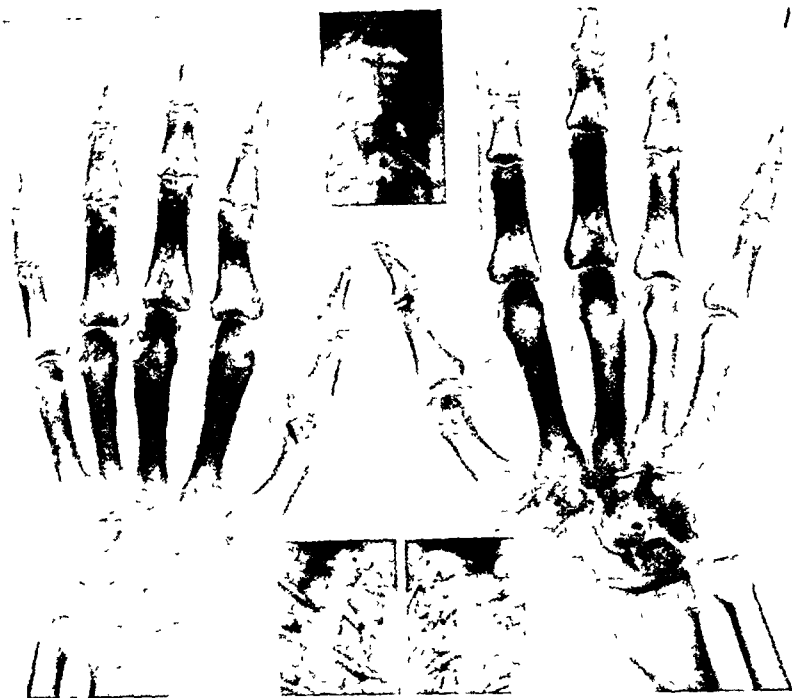


Fig 4 Case 6 Bones of left hand greatly rarefied. Posterior subluxation of third vertebral body (no trauma). Step formation on both sides in the posterior margins of the fourth foramina, and in the left third foramen.

this pathogenetic mechanism is so difficult to obtain that the correlation has been frequently (and again very recently) denied or questioned (6, 15). It is true that spinal changes believed to cause radicular neuritis¹ are often found also in persons who are free from all symptoms. But this is due to the inconstancy of the relation between the width of the foramina and the caliber of the nerves that pass through them. The nerves are especially thick in the lower cervical and lower lumbar regions, where the foramina are not wider than in adjacent sections in which the nerves are more slender. Moreover, there are persons in whom the foramina are constitutionally wide, while in others, a certain amount of narrowing is physiological because of various postural factors. Hence it is the relative rather than the absolute amount of bony alteration which is responsible for compression of nerve roots,

¹The term "radicular neuritis" is here used instead of "radiculitis," because the latter is a hybrid and because "radix," the root, is of ambiguous meaning. It would be more correct to speak of radicular nerve lesions, the inflammatory "itis" not being verifiable. I am indebted to Dr. W. T. Van Dyck for his having suggested this modification.

and it is natural that identical bony changes do not cause radicular neuritis in every instance. It is also true that neurologic symptoms identical with those found in certain chronic diseases of the column may occur in the absence of any demonstrable spinal changes. But this has little bearing upon the question here discussed, first, because radicular neuritis is obviously not pathognomonic of disease of the spine, and, second, because vertebral changes around the foramina do not become visible, as a rule, on "routine" roentgenograms. The statistics so far published are based upon anteroposterior and lateral views only, hence it is very probable that a certain number of spinal changes responsible for radicular neuritis have hitherto escaped recognition. Cases 4 and 5 show that these pathological formations appear to be insignificant in the conventional technique, although in reality they may reduce the width of the foramen to less than one-half of its original size (Figs 2 and 5). Finally, it has been stated that on

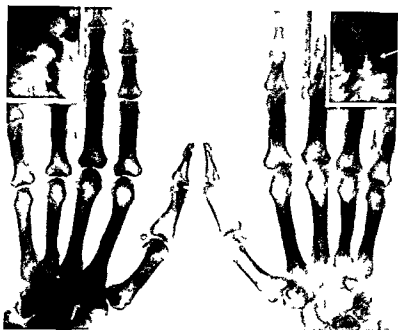


Fig. 3. Case 1. Bones of right hand demineralized. Right fourth foramen narrowed by displacement forward of a fractured fifth superior articular process (arrows). Left side normal.

It would seem that the changes under discussion are similar in nature to those trophic lesions which are occasionally observed in chronic diseases of the spine as e.g., "symptomatic" herpes zoster (18).

THERAPY

Only 7 of the 14 patients underwent treatment. They were given a series of ultra short wave treatment over the neck (6 meter wave length, electrodes at 10 centimeters distance from the skin on either side of the neck, each treatment 20 minutes). A total of from 5 to 24 treatments was given over periods varying from 1 to 10 weeks. Six of the patients responded almost immediately; pain and swelling subsided after the third or fourth treatment and did not recur during the subsequent 7 to 13 months (the patients are still under continuous observation). In the course of several months after termination of the therapy both the muscles and bones regained normal or almost normal appearance while slight degrees of atrophy of the skin persisted.

Treatment was often prolonged because of pain in the deltoid region, arm or neck.

In one instance (Case 1 of the table) no result was obtained either by this or by other modes of treatment. In this patient a fractured articular process was displaced into the intervertebral foramen. Operation was proposed, but not accepted.

No other therapy whatever was used. Since the aspect of the narrowed foramina did not change after the treatment it is probable that this therapy acted upon the nerves e.g. by decongestion of their sheaths.

CORRELATION OF RADICULAR NEURITIS WITH BONY CHANGES AROUND FORAMINA

The findings seem to indicate that the syndrome here described is a trophic disorder caused by pressure upon cervical nerve roots within the intervertebral foramina. It has been known clinically for more than a century that changes in the limbs may be the result of chronic disease of the spinal column but up to the present direct and conclusive proof of

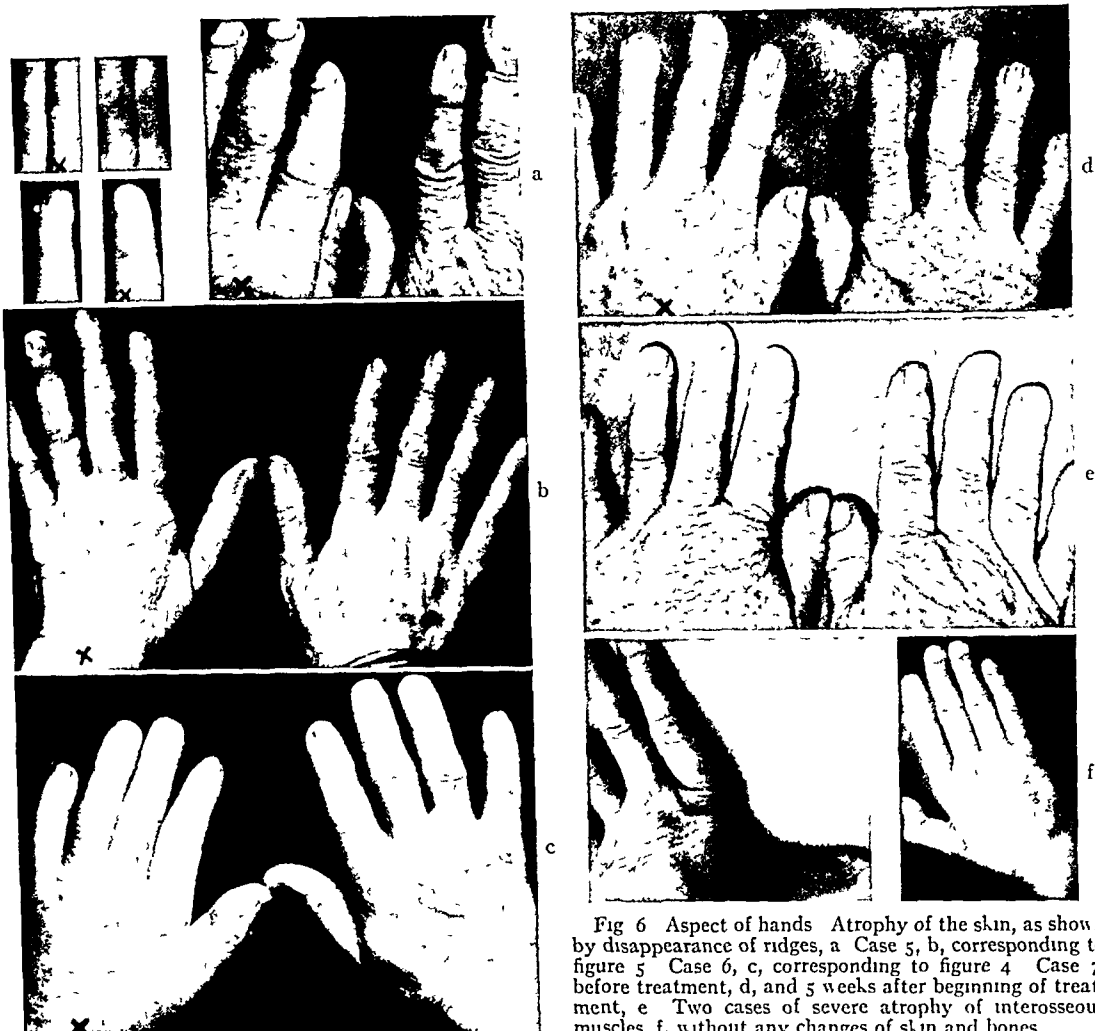


Fig 6 Aspect of hands Atrophy of the skin, as shown by disappearance of ridges, a Case 5, b, corresponding to figure 5 Case 6, c, corresponding to figure 4 Case 7, before treatment, d, and 5 weeks after beginning of treatment, e Two cases of severe atrophy of interosseous muscles, f, without any changes of skin and bones

The various lesions that may produce narrowing of intervertebral foramina have been discussed in previous reports (12, 17) It may here be mentioned that the foramina are often *not* involved in the most conspicuous vertebral alterations—e g Pott's disease and hypertrophic spondylitis—whereas very slight changes in the intervertebral discs and articular processes often lead to marked narrowing of foramina. This is shown only on roentgenograms in which the foramina are projected in optical section, "routine" roentgenograms are here misleading, for they commonly fail to reveal the bony changes in question

This report cannot in any way help to elucidate the question as to whether trophic disorders are due to lesions of hypothetical trophic nerves, or whether they are merely incidental to vascular, motor, and sensory disturbances (7, 11) But it would seem that the correlation of a particular type of trophic lesion with distinct bony changes around the corresponding intervertebral foramina is here demonstrated by the constancy of the spinal changes, by the almost experimental production in 3 cases of the trophic disorder as a result of injuries that caused constriction of the corresponding foramina, by the gradual develop-

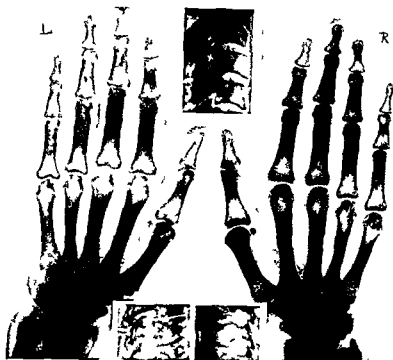


Fig 5. Case 5. Bones of left hand rarefied. Left third articular process irregularly rarefied and thinned (cross); reactive exostoses at its posterior borders (black arrows). Rounded exostosis bulging into left third foramen (white arrow).

autopsy, bony changes around the foramina are not found to be sufficiently marked to account for compression of nerve roots. But the position of the articular processes—the main factor involved in narrowing of foramina—differs in autopsy from that found roentgenologically in the living patient because of the absence of postural load and muscle tone, moreover dehydration of soft tissues post mortem may cause the nerves to appear thinner than *in vivo*, and slight alterations in the nerve e.g. edema of its sheath while causing well marked clinical symptoms may not be verifiable on autopsy. Incidentally no mention is made of histological examination of the nerves in those reports in which the correlation under discussion is denied.

It would seem then that the objections quoted are not significant enough to disprove the correlation of radicular neuritis with bony changes around the foramina. Considerable uncertainty, however, arises from the difficul-

ties encountered in recognizing, clinically both early and chronic stages of radicular neuritis. The classical syndrome of sensory and motor disturbances in segmental distribution is not always fully developed, and the symptoms are often indefinite or ambiguous (17). The patients may complain of vague rheumatism in the back and shoulders radiating to the extremities of moderate distibity, of impairment of certain movements of weakness of the grip, of paresthesia not confined to nerve segments. Objective sensory disturbances are very commonly not demonstrable, the reaction of degeneration is generally negative and it is not until in the course of many years a group of muscles has become atrophic that radicular neuritis is suggested by these symptoms. As a rule the correlation with a chronic lesion of the spine does not become evident for the reason that the spinal section involved in a majority of cases is neither painful nor rigid.

NORMAL AND PATHOLOGICAL DEVELOPMENTS FROM THE CELLS LINING THE GRAAFIAN FOLLICLE

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THE object of this study is to follow the cells lining the primordial graafian follicle through their normal development and recession, and to trace the early beginnings of some of the pathological growths which can be shown to have their origins from these cells. Of the later developments of these growths much is known, but of their beginnings very little is known. Why they begin is a question the answer to which we have only an inkling.

The only structure in the cortex of the ovary aside from the dense connective tissue that makes it up is the primordial graafian follicle. The embryologists have taught us what happens to the ovum in the course of normal development, but the story of the lining cells of the graafian follicle is incomplete and often very hazy. To get a comprehensive view it is necessary to follow these cells through their many normal changes and to note the variations from the normal.

The primordial graafian follicle is very minute in size and contains a single cell, the immature ovum, and is lined by a single layer of small cells.

There is much confusion in the classification of the lining cells of the graafian follicle. They are commonly spoken of as epithelium or as germinal epithelium. This insistence on calling this layer of cells epithelium makes it practically impossible to explain their later development into connective tissue; because epithelial cells are considered a finished product, and when they reproduce, the new cells are the same as the original type.

On the other hand Ramon Cajal (1) states: "In 1918 Pedro Ramon successfully applying the methods of Golgi to the study of the graafian follicle has proved that the cells of the stratum granulosum as well as those of the discus proligerus are connective type." The

conclusion of Pedro Ramon makes easy the following of these cells through their normal phases to the corpus albicans but makes difficult the explanation of the development from granulosa cells of several types of epithelium in the development of pathological growths.

Both of these difficulties are easily surmounted if we go back to the fact that these cells have the same embryological origin as the ovum, the ovum really is one of these cells that has been set apart. From the ovum is developed every type of cell found in the body. Since the cells lining the cavity of the graafian follicle are so closely related embryologically to the ovum, it is not surprising to see that they do not always follow a single line of growth, but may under varying stimuli produce a variety of types of cells.

The cells that are originally the lining of the primordial follicle are in the course of their normal development called by several different names. In the beginning they are called epithelium, or germinal epithelium or germinal cells. After the rupture of the follicle and the escape of the ovum, they are called lutein cells. When the lutein cells become hyalinized and form the corpus albicans, they are called connective tissue cells; in the atretic cysts they are known as granulosa cells. All these names are used for the same group of cells during normal development. In pathological growths it can be shown that the granulosa cells develop into several types of epithelium.

The normal graafian follicle follows one of two lines in its development.

1 The ovum grows in size, the lining cells increase in size and multiply rapidly, and finally the follicle ruptures and the ovum is extruded. The lining cells now called lutein cells form a mass of considerable size, the corpus luteum, which undergoes hyalinization and forms a connective tissue structure, the corpus albicans.

ment, in 3 other cases, of the trophic disturbance following a period of severe pain in the neck due to bony changes in the cervical spine by the occurrence, in cases of bilateral affection of foramina, of the trophic lesion on the side more severely affected, and by the results of treatment directed exclusively to the cervical spine

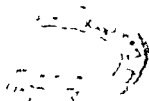
SUMMARY

In 14 patients, a peculiar swelling accompanying atrophy of the skin, interosseous muscles and—less constantly—of the bones of one hand was found to be correlated with unilateral bony constriction of intervertebral foramina in the upper cervical spine on the side of the affected hand. The clinical syndrome was independent of the nature of the disease that produced this constriction. In 6 of 7 patients treated, cure was obtained by ultra short wave therapy over the cervical spine. Atrophy of the bones was found to be correlated with atrophy of the skin but was independent of atrophy of the muscles.

The development of well marked trophic lesions in an extremity affected for many years, by "rheumatic" or "arthritic" pain seems to indicate that in a certain group of cases rheumatism may be due to radicular neuritis caused by chronic diseases in the spinal column.

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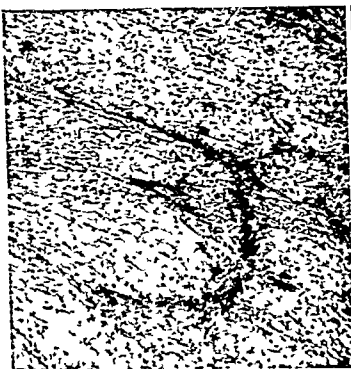


Fig 7

Fig 7 A corpus luteum older than that in Figure 6 showing the progressive changes

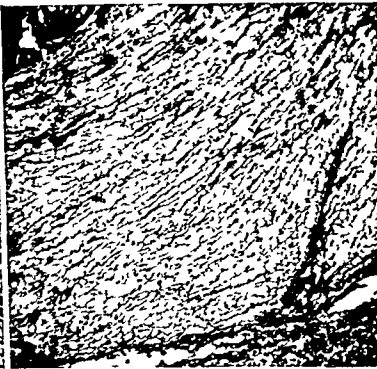


Fig 8

Fig 8 Section showing still further degeneration of the cells

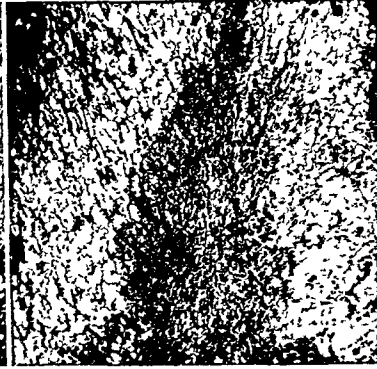


Fig 9

Fig 9 Almost complete hyalinization of the cells adjacent to the central degenerating blood clot. Outside of this area a group of cells that are rapidly losing their identity as lutean cells

NORMAL DEVELOPMENT OF FOLLICLES

When the graafian follicle begins to develop the first change observed is that the lining cells are increased in number and are increased in their size, but they form only a single layer (Fig 1). As the growth continues, other cells appear inside the outer layer (Figs 2 and 3), and these continue to form until the ovum is surrounded solidly by many layers of cells (Fig 4). At this stage the ovum and the lining cells are much enlarged.

At some stage in the latter part of the growth of the follicular contents, a clear space

over and outlining the discus proligerus appears, but in this series, no follicle showing this clear space has been found. The presumption that it is formed is founded upon the fact that every atretic cyst, which is only a graafian follicle that has been checked in its development, shows such a clear area.

Finally after the ovum and surrounding cells reach complete development and the cortex of the ovary has been softened by the new-growth of the contents of the graafian follicle, the ovum breaks through and is discharged into the abdominal cavity. The cells



Fig 10

Fig 10 The process of hyalinization is almost complete. A few nuclei are still present and there remain vague lines indicating old cell outlines.

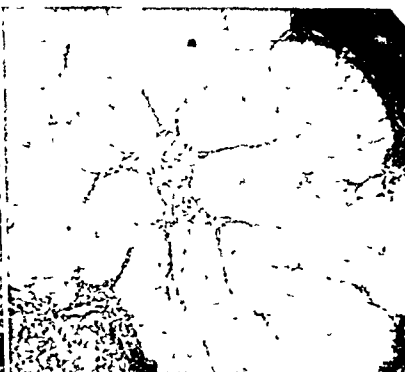


Fig 11

Fig 11 Hyalinization is practically complete. A few nuclei are still present. The whole mass had decreased



Fig 12

in size to a small fraction of the original corpus luteum.

Fig 12 A graafian follicle that has been checked in its development. The granulosa cells are clumped and drawn away from the theca. The outer layer of granulosa cells are very dark.



Fig 1



Fig 2

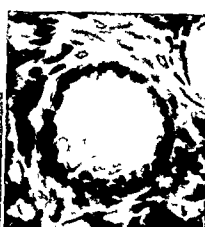


Fig 3

Fig 1 Beginning development of the cells of a graafian follicle. A single layer of cells. The number of cells is increased and the size of the cells is increased.

Fig 2 Three follicles are shown one shows marked

development the other two are just beginning to develop.

Fig 3 Higher magnification of the middle follicle shown in Figure 2. The lining cells are just beginning to proliferate inside the original layer.

King states 'The vast majority of graafian follicles present in an ovary do not become mature but undergo atresia. Just before the time of ovulation a number of follicles are approaching maturity. The rupture of one of these is accompanied by a regression of the others. This has been shown experimentally in birds by Pearl and Surface and in rodents by Hermann and Stein to be due to the presence of a hormone produced by the developing corpus luteum.

King further states that there are various forms of regression (1) absorption (2) atresia with cystic development (3) atresia with proliferation of the stratum granulosum and cystic formation (4) atresia with proliferation of the stratum granulosum without cystic formation.

For present purposes interest centers on group 2, atresia with cystic development and group 3, atresia with proliferation of the stratum granulosum and cystic formation.



Fig 4



Fig 5



Fig 6

Fig 4 An ovum with its nucleus and zona pellucida surrounded by layers of evenly distributed lining cells.

Fig 5 A small portion of one lobule of an early corpus luteum. The cells are large, the outlines are difficult to reproduce, the nuclei are numerous and clearly defined.

The lutean cells are definitely limited by the ovarian stroma.

Fig 6 A corpus luteum a little older than that in Figure 5. The cells are paler and the nuclei are not quite so numerous.

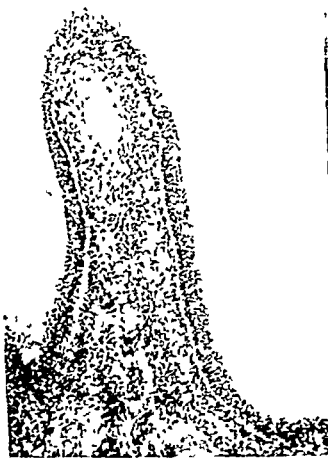


Fig 19



Fig 20



Fig 21

Fig 19 An elongated discus in an old atretic cyst. It is covered by several layers of granulosa cells while the bulk of it is made up of immature connective tissue cells.

Fig 20 A discus similar to Figure 18, but smaller. The granulosa cells are reduced to one or two layers, while the

remainder of the mass of tissue is connective. Both have light areas near the apices which may indicate the location of the long degenerated ovum.

Fig 21 A grotesque discus in a large atretic cyst, with small light spot near the apex present in Figures 18 and 19.

The bulk of the mass is made up of closely packed large cells with large dark staining nuclei. The line separating these cells from the ovarian stroma is sharply defined and this line of separation remains distinct throughout the process of recession.

CORPUS ALBICANS

The formation of the corpus albicans from the corpus luteum is a recessional process. There is no new-growth of cells either luteal or cortical. The whole mass of luteal cells becomes smaller, the individual cells gradually lose color and diminish in size, and the nuclei become smaller and finally disappear. The process is very much like the hyalinization that takes place in uterine fibroids. The whole mass continues to decrease in size after the disappearance of the cell structure and ultimately disappears. This process of absorption is very slow and almost every ovary from an adult shows numerous corpora in various stages of disappearance (Figs 6 to 11).

THECA

When the graafian follicle begins to grow there is a change in the cells of the ovarian

cortex immediately surrounding the follicle. These cells become edematous, enlarge in size, and take less hematoxylin stain than the unmodified cortex cells. This is the theca (Figs. 12 and 13). It is not a new-growth, it is not a part of the graafian follicle, and it takes no part in the formation of the corpus albicans. The nearest analogue to the cells of the theca are the decidual cells that form in the connective tissue of the endometrium or in the connective tissue of the fallopian tube when an ovum is developing in the immediate neighborhood.

This softening of the cortex is only a process of decreasing the resistance of the firm cortical tissue to allow the ovum to escape by rupture from the follicle into the abdominal cavity. The thecal cells persist especially around atretic cysts for a considerable time and gradually change back to their original type and merge with the other cortical cells (Fig 14).

In the microscopical examination of ovarian sections, the identification of the theca is not absolutely necessary but helps in the identification of spaces that arise from graafian follicles. In the younger growths it is easily



Fig 13

Fig 13 A graafian follicle that has been checked in its development. A degenerating ovum. The granulosa cells are in contact with the theca. The outer layer of granulosa cells takes a very dark stain.



Fig 14

Fig 14 The theca almost completely restored to the original type of connective tissue cells of the cortex.



Fig 15

Fig 15 A relatively young atretic cyst. The ovum is well developed and shows the nucleus and zona pellucida. Surrounding it are the cells of the discus proligerus. The granulosa cells lining cavity are in many layers. Outer layer stains more darkly than the others. A definite cleavage exists between the granulosa cells and the surrounding theca.

which remain in the ovary after the escape of the ovum are in the form of a mass called the corpus luteum. It is irregularly lobulated and has in its center an irregularly shaped space filled with blood. This space is relatively small but varies much in size.

The size of the corpus luteum, when compared with that of the primordial follicle from which it is derived, is an enormous body. The one from which this picture (Fig 5) was made is about 12 millimeters by 18 millimeters. The field shown is only a portion of one lobule.

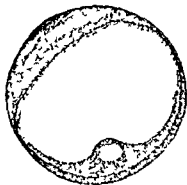


Fig 16

Fig 16 An atretic cyst older than the one shown in Figure 15. More fluid has accumulated. The layer of granulosa cells is thinner. The ovum has a clear zona pellucida. The single layer of darkly stained cells marks the outer border of the granulosa cells. Beyond these are the thecal cells.



Fig 17

Fig 17 An atretic cyst similar to Figure 16 except that in this one there are three sunken spaces in the discus. The one nearest the center of the cyst shows faintly the



Fig 18

zona pellucida of an ovum. The outer space is very regular in shape but shows no nucleus and no zona pellucida. It is possible the graafian follicle of which this atretic cyst is the remains may have started at level of two or more ova.

Fig 18 Only a segment of a relatively large atretic cyst. The diminishing discus still has an ovum with its nucleus and zona pellucida. The basal layer of dark granulosa cells marks clearly the limits of the theca on the left side and the dark cortex cell on the right side.



Fig 28

Fig 28 The same section as shown in Figure 27 under higher magnification. A small segment of the ovarian cortex, the full thickness of the lutein cells, and a segment of the connective tissue which lined the cavity of the cyst are demonstrated.



Fig 29

Fig 29 Goblet cells lining a small ovarian cyst. Intracystic pressure relatively low.

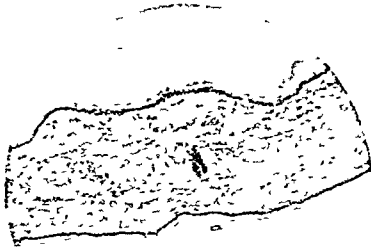


Fig 30

Fig 30 Goblet cells lining two spaces in a multilocular cyst. Height of cells less than in Figure 28 because of greater intracystic pressure.

to eight cells deep in some cysts, while in others they thin out to one or two layers (Figs 25 and 26).

The number of layers of granulosa cells in an individual cyst may vary greatly (Figs 23 and 24). In some of the older cysts, the granulosa cells are evenly thinned out to one or two compressed layers. A distinct demarcation is always present between the granulosa cells and the surrounding cortex of the ovary. Under normal conditions, there is never any intermingling of the granulosa cells and the thecal cells.

During the menstrual life of every woman, atretic cysts are found in the ovaries. They are normal products of the process of ovulation and consequently it is rarely necessary to remove them. Undoubtedly many of the larger thin-walled ones rupture spontaneously. Occasionally one is ruptured during a bimanual examination. Very rarely one attains such a size as to give rise to pelvic discomfort from pressure, or very exceptionally one has a twisted pedicle. On the whole the atretic cyst should be looked upon as a normal structure and left to take care of itself.



Fig 31

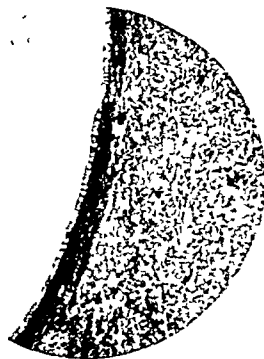


Fig 32

Fig 31 A very low power magnification of an old atretic cyst. One side is lined by goblet cells which gradually fade into a single layer of granulosa cells. The other side has a single layer of granulosa cells (see Figs 32 and 33).

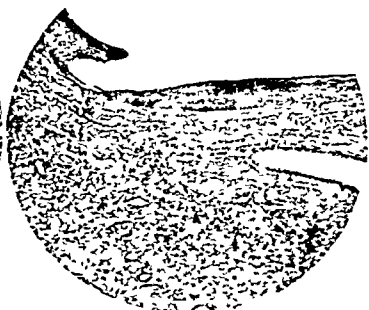


Fig 33

of the cyst shown in Figure 31. The goblet cells present are the same as are found in the adenocystoma.

Fig 33 Another portion of the lining of the cyst shown in Figure 31. There are no indications of goblet cells. Only a very thin layer of granulosa cells are present.

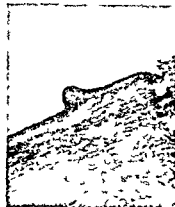


Fig 22

Fig 22 The remains of a discus in a large and old atretic cyst. A single layer of granulosa cells lines the cyst cavity on either side and extends over it. Everything beneath the layer is connective tissue.



Fig 23

Figures 23 and 24 are from two sides of old atretic cyst to illustrate the variety in appearance of granulosa cells in the same cyst. Figure 23 shows a layer of granulosa cells of six to eight layers. Figure 24 only a single layer.

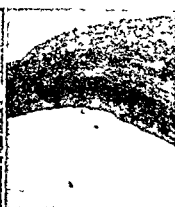


Fig 24

identified, but in the older ones in many instances the thecal cells have so nearly returned to their original status that they are difficult to distinguish from ordinary cortical cells. When present they closely define the line between cortical and intrafollicular structures.

ATRETIC CYSTS

As has been stated previously when the mature graafian follicle ruptures a hormone is thrown out by the corpus luteum that stops all the other developing follicles. It seems to

have no effect upon follicles that have not begun to develop. One of the most common changes in the developing follicle that has been stopped in its growth is the formation of a small cyst, an atretic cyst. The lining cells are granulosa cells. They are much smaller than lutein cells and also smaller than those in partially developed follicles from which they were derived. The cells are piled up around the ovum and form the discus proligerus. Lining the remainder of the cyst these cells are found in irregular layers of four



Fig 25

Fig 25 The granulosa cells are reduced to a thin line. Beneath are the longitudinal connective tissue cells of the theca.

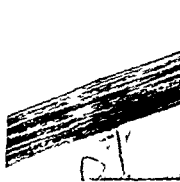


Fig 26

Fig 26 A single thin layer of granulosa cell lining an old atretic cyst.

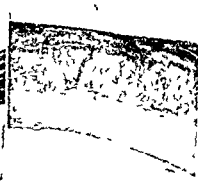


Fig 27

Fig 27 A very low power picture of the whole thickness of the wall of a corpus luteum cyst. In the upper part of the picture is normal ovarian tissue. Just below that is a layer of lutein cells and below that newly formed connective tissue is seen.



Fig 28



Fig 29



Fig 30

Fig 28 The same section as shown in Figure 27 under higher magnification. A small segment of the ovarian cortex, the full thickness of the lutein cells, and a segment of the connective tissue which lined the cavity of the cyst are demonstrated.

Fig 29 Goblet cells lining a small ovarian cyst. Intracystic pressure relatively low.

Fig 30 Goblet cells lining two spaces in a multilocular cyst. Height of cells less than in Figure 28 because of greater intracystic pressure.

to eight cells deep in some cysts, while in others they thin out to one or two layers (Figs 25 and 26).

The number of layers of granulosa cells in an individual cyst may vary greatly (Figs 23 and 24). In some of the older cysts, the granulosa cells are evenly thinned out to one or two compressed layers. A distinct demarcation is always present between the granulosa cells and the surrounding cortex of the ovary. Under normal conditions, there is never any intermingling of the granulosa cells and the thecal cells.

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Fig 31

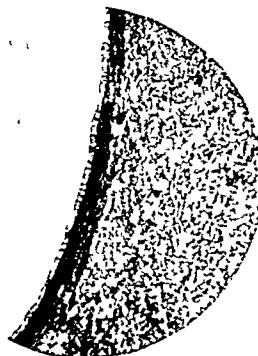


Fig 32

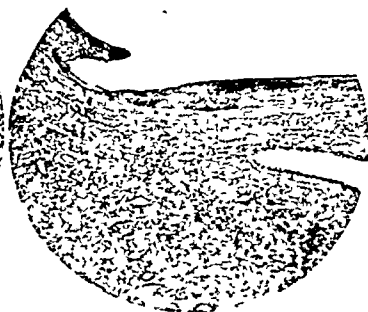


Fig 33

Fig 31 A very low power magnification of an old atretic cyst. One side is lined by goblet cells which gradually fade into a single layer of granulosa cells. The other side has a single layer of granulosa cells (see Figs 32 and 33).

Fig 32 A higher magnification of the lining on one side

of the cyst shown in Figure 31. The goblet cells present are the same as are found in the adenocystoma.

Fig 33 Another portion of the lining of the cyst shown in Figure 31. There are no indications of goblet cells. Only a very thin layer of granulosa cells are present.

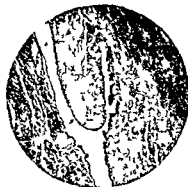


Fig. 34



Fig. 35



Fig. 36

Fig. 34 A cavity lined partly by granulosa cells and partly by goblet cells.

In some parts there is a tendency to proliferate suggesting a possible early malignancy.

Fig. 35 Gland like spaces lined by goblet epithelium.

If a section of a comparatively recent atretic cyst is cut at a lucky angle the discus proligerus will be cut through and the ovum will be bisected. The ovum is a large round clear cell surrounded by its capsule, the zona pellucida and within is the nucleus and nucleolus. Heaped around the ovum is a mass of granulosa cells the discus proligerus (Figs. 15, 16 and 17).

In the older atretic cysts the discus assumes a great variety of shapes due to disintegration and change in type of the cells of which it is composed. These shapes vary from irregular heaps of cells to tongue like projections or small rounded firmly organized

masses with no indication of the location of the ovum. Frequently the old discus consists of a mass of connective tissue with only a thin fringe of disintegrating granulosa cells covering it. Running straight across the field under the base can be traced the remains of the theca (Figs. 18, 19, 20, 21, and 22).

LUTEIN CYSTS

The only apparent difference between lutein cysts and the much more frequently seen atretic cysts is the stage of development of the graafian follicles when their growth is stopped by the hormone thrown out from a mature corpus luteum. The lutein cyst is



Fig. 37



Fig. 38



Fig. 39

Fig. 37 In the center is a mass of detritus from an old atretic cyst. Where the lining of the cavity should be is a ringlike mass of carcinoma cells. Outside the space the theca is clearly defined.

Fig. 38 An old ovum projecting into it is a papillomatous growth. Fig. 39 An old atretic cyst. The greater part of it is lined by granulosa cells. From the segment papillomatous tissue has displaced the granulosa cells and is growing into the cavity of the cyst.

Fig. 39 An atretic cyst containing the remains of a discus.

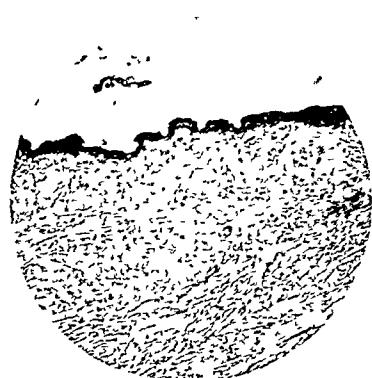


Fig 40



Fig 41



Fig 42

Figs 40 and 41 Both photomicrographs from the same atretic cyst. Figure 40 shows a beginning papilloma.

Figure 41 shows no evidence of papillomatous tissue.

Fig 42 Papilloma similar to that shown in Figure 39.

lined not by granulosa cells but by cells similar to those found in a corpus luteum. In the cyst illustrated is seen a thick layer of lutein cells next to cortical tissue. Between the lutein cells and the cyst cavity is a heavy layer of connective tissue cells (Figs 27 and 28).

GOBLET CELLS

The granulosa cells in atretic cysts present a variety of appearances, and before it is possible to recognize pathological changes in them it is necessary to be familiar with the

various normal types: the heaped up cells of the discus, the many layers in the newer cysts, and the thin pressed out cells of the older cysts. This last group is the most important, because it is from this group that the pathological cells develop (Figs 25 and 26).

It seems hardly necessary to say that to learn the beginnings of pathological growths it is necessary to find them when they are very small and before they have caused much destruction or disintegration of the normal ovarian structure.



Fig 43

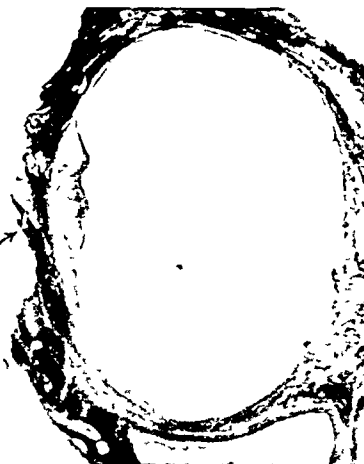


Fig 44



Fig 45

Fig 43 A malignant papilloma. Section from another field on the same slide from which Figure 42 was made.

Fig 44 An atretic cyst 11 by 7 millimeters. A small dermoid tumor, arrow, is growing within the cyst and is apparently at site of discus. Circa 5-6 diameters.

Fig 45 A low power magnification showing the whole growth. Beneath the growth runs the remains of the theca showing that the growth is within the cyst. The light area of the growth is sebaceous gland material. The dark area facing the cyst cavity is made up of granulosa cells.



Fig 46

Fig 46 One portion of the growth showing in more detail the granulosa cells and the sebaceous glands

Fig 47 A field showing one end of the growth with the granulosa cells piled upon the sebaceous gland growth and continuing beyond the growth in a single layer. Below the growth and between the growth and the unmodified



Fig 47



Fig 48

cells of the cortex is a pale layer of cells—the remains of the theca

Fig 48 A dermoid growth showing sebaceous glands in the ovarian stroma and a growth of squamous epithelium that is creeping along the lining of an atretic cyst displacing the granulosa cells

The goblet cell of the adenocystoma growing in a single layer with its dark base and white top is easily recognized by the amateur microscopist, because it is distinctive (Figs 29 and 30). To find a group of small cysts in an ovary lined by goblet cells is no proof that they developed in atretic cysts. To find in one slide a group of small cysts some lined completely with goblet cells and others lined completely by granulosa cells is suggestive but only inferential evidence that the goblet cells developed from the granulosa cells, but when a small cyst is found partly lined by normal granulosa cells and partly lined by

pathological goblet cells, it is practically conclusive that the goblet cells are developing from the granulosa cells. It is certain that the granulosa cells were there first.

Several slides showing both granulosa cells and goblet cells lining cyst walls have been found. Two of these are illustrated. One when the cyst was too large to allow sufficient magnification to show the character of the lining cells in one field is illustrated by three photomicrographs. Figure 31 shows the whole cyst with the goblet cells showing faintly on one side. Figure 32 is a higher magnification that brings out plainly the goblet cells while



Fig 49

Fig 49 Another portion of the wall of the cyst shown in Figure 48. Here the lining of the cyst wall is a single layer of granulosa cells



Fig 50



Fig 51

Fig 51 Another field in the same cyst shown in Figure 50. The transition of granulosa cells to squamous epithelium



Fig 52



Fig 53

Fig 52 Very similar to Figure 48 The replacement of granulosa cells by squamous epithelium

Fig 53 Another field of the same slide from which Figure 52 was made This is a papilloma and is growing about 5 millimeters from the dermoid

the opposite side of the cyst, Figure 33, shows only a thin layer of granulosa cells. In the second slide, the cavity was so small that both sides of it could be brought into one field and shows both the goblet cells and granulosa cells in one picture (Fig 34).

The goblet cells are a type of true epithelium. From these cells carcinoma may develop. The fully developed carcinoma is usually very easy to recognize, but the one that is just beginning on its career of malignancy is open to various interpretations. Figure 35 illustrates such a condition. Various opinions have been expressed, and it is left as doubtful. On the other hand, Figure 36 is from a well developed ovarian adenocarcinoma.

Another type of carcinoma is shown in Figure 37. There is nothing to indicate the type of epithelium from which it developed, but there is fair evidence that it started in an atretic cyst. In the center is a mass of detritus such as is often seen in atretic cysts. Where the granulosa cells should be, is a thick circular mass of carcinomatous cells. Outside of the whole, a theca-like structure is clearly indicated.

PAPILLOMA

The beginnings of papillomas of the ovary are very much the same as the development of the goblet cells of the adenocystomas. In numerous sections there can be shown the progressive development of the special type of epithelium which is found in papillomas

from the granulosa cells of old atretic cysts. Figure 38 is clear evidence of a papilloma in an atretic cyst. We know the space is an atretic cyst by the presence of a portion of the discus containing a degenerated ovum. Projecting into the cyst is a papillomatous growth. This is no evidence that the growth started in this cyst. It could have broken through the wall of the cyst.

The beginning of a papilloma in an atretic cyst is shown in Figure 39. In this instance about three-fourths of the lining of a small cyst is granulosa cells. In the remaining fourth, a papilloma is developing directly from the granulosa cells.

In many instances, the early papilloma is found in old atretic cysts too large to be photographed as a whole. Figures 40 and 41 are made from such a cyst. In one is a dark thickened layer of cells that have begun to pile up. In the other a thin layer of cells that are only slightly modified granulosa cells.

All papillomas are potentially malignant but the degree of malignancy is very variable. Some have been known to grow for years with little invasion and very little destruction of tissue. Figure 42 shows no definite indications of malignancy while Figure 43 from the same slide is definitely malignant.

DERMOIDS

According to Ewing it is generally accepted that dermoids of the ovary have their origins

in unfertilized ova. This assumption can be very nearly demonstrated in the specimen illustrated (Figs 44, 45, 46 and 47).

The ovary from which this section was made was not enlarged and grossly showed a small atretic cyst. It was removed with a large uterine fibroid and the growth was discovered at routine pathological examination.

The atretic cyst measures 11 millimeters in its long diameter by 7 millimeters in the transverse. The growth occupies only a small segment of the circumference of the cyst. Outside of it the continuous line of the theca is clearly seen, demonstrating that the growth is intracystic. Piled upon the growth are many layers of granulosa cells while the remainder of the cyst is lined by the ordinary thin layer of granulosa cells commonly seen in old atretic cysts. The piled up granulosa cells indicate the position of the discus, and the position of the dermoid growth indicates that it started in the center of the discus and that is where the ovum should have been.

In another section heavy squamous epithelium is seen creeping along the wall of an atretic cyst displacing the granulosa cells. Beneath the squamous cells are sebaceous glands and hair follicles. The opposite side of the same cyst is lined by granulosa cells not yet affected (Figs. 48 and 49).

In a third section the heavy layer of squamous epithelium is seen lining a part of an atretic cyst and fading off into granulosa cells. On opposite side of same cyst squamous cells shift abruptly to granulosa cells (Figs. 50 and 51).

The first of these three sections shows sebaceous glands developing in a discus. The other two show the gradual change from granulosa cells to squamous epithelium.

One slide shows a cavity partially lined with growing squamous epithelium (Fig. 52) near it are sebaceous glands, hair follicles and sweat glands. Within a few millimeters is a second cyst developing a papilloma, and also showing normal granulosa cells (Fig. 53).

In this series of pictures an effort has been made to show that the cells lining the primordial graafian follicle follow many lines of development. These variations in development are partially due to their embryological structure, and secondarily due to the influence

of external agencies. We have some knowledge of some of these agencies. We know that the graafian follicle is induced to grow by the presence of a hormone. We know that when a mature graafian follicle ruptures it throws out a hormone that immediately counterbalances the growth hormone and stops the growth in all the other developing follicles.

The explanation of the further changes in the granulosa cells which result from the first process is a matter of speculation which in time will no doubt be cleared up. It seems reasonable to assume that since the normal changes are due to the action of hormones the abnormal changes are due to a similar influence. As evidence of the correctness of this assumption "William Cramer (2) and F. S. Horning have studied the carcinogenic properties of hormones. Estrogen is closely related chemically to some of the carcinogenic hydrocarbons. It is therefore not surprising that some of these induce estrus. But when tested by painting on the skin the estrogens proved inactive. Subsequently, Lacassagne found that subcutaneous injection over many months produced mammary cancer, even in mice. This has been confirmed by several workers. It therefore seemed that a substance can be carcinogenic for one organ (the mamma) and not for another (the skin). To test this point Cramer and Horning applied a dilute solution of estrogen to the skin of male and female mice for a prolonged period. The surprising result was that cancer developed in the mamma but not in the skin, and as readily in males as in females. This result indicates an organ specificity for carcinogenic agents a fact not previously suspected. Some apprehension has been aroused as to the danger of using estrogen but Cramer and Horning have shown that carcinogenesis requires much larger doses and much longer periods than those of therapeutic administration.

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SCOLIOSIS

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ALL students of scoliosis have appreciated two facts. (1) that early recognition of the deformity is the most important single factor in its management, and (2) that persistent and continuous treatment is necessary to obtain a satisfactory result. Early recognition of this lesion assures the opportunity of preventing the severe grades of the deformity, thus preventing the many and distressing physical, functional, and psychic complications. It is my intention to review the salient features of the symptomatology, etiology, and pathology of scoliosis so that we may have a clear concept of its clinical aspects, and to discuss the various forms of treatment, their application, and their results, in order that we may more accurately advise our patients.

DEFINITION

Scoliosis is a deformity of the trunk in which the most conspicuous element is a rotary lateral curvature of the spine. Frequently we are inclined to think of scoliosis as relating only to the spine. This is an error. While changes in the conformation of the trunk and in the function of the viscera may be as difficult to recognize in the early cases as they are obvious in the advanced stages, yet pathological studies have shown that the thoracic cage and all of the thoracic and abdominal organs are involved in all instances and the change in morphology and function is in direct proportion to the severity of the deformity, of which the degree of the curvature of the spine is a fairly accurate index. Consequently, as a matter of convenience, scoliosis is described in terms of the curvature of the spine.

TYPES OF SCOLIOSIS

There are two types of scoliosis, the functional and the structural. A functional scoliosis

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is a temporary physiological distortion of the trunk with a lateral deviation of the spine. This can be corrected by voluntary effort particularly after some instruction. There are no architectural changes in the skeleton and no alteration in the shape and function of the viscera. Functional scoliosis is common between the tenth and twentieth years. In a typical case of left dorsal scoliosis the spine is deviated to the left, the left shoulder is higher than the right, there is increased prominence of the left side of the back. The right iliac crest, commonly but incorrectly referred to as the "hip" is more prominent than the left. In a right dorsal functional curvature the findings are the opposite of those just described. When the patient bends forward the asymmetry of the back disappears completely. After some instruction the patient can stand erect with his back entirely symmetrical. An x-ray film made in the usual or supine position shows a normal spine and normal ribs.

TREATMENT OF FUNCTIONAL SCOLIOSIS

A cure may be effected by the following procedure. All potentially causative agents should be removed. Thus a child should not be permitted to carry a heavy load of books continuously on one side of the body. The clothing should be adjusted so that there is no unequal pull on the shoulders. Visual and auditory deficiencies must be removed or compensated. Obesity must be rectified by dietary restriction. An explanation should be given to the patient, if old enough, of the nature of the faulty attitude and he must be patiently shown how to sit, stand, and walk correctly. Corrective and symmetrical gymnastic exercises should be taught and these should be performed daily for many months under the direct supervision of the physician or one specially trained in this type of work. These exercises improve muscle tone, serve as a stimulus to physical activity, and de-

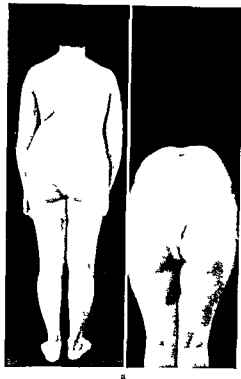


Fig 1 Right dorsal curve. a Photographs of patient standing erect and bending forward. Note asymmetry of back, deviation of dorsal segment of spine to the right, prominence of left iliac crest (hip), incurvation of left side of abdomen and backward projection of ribs on right side. b X-ray picture showing deviation of dorsal vertebrae to the right with apex of curve at seventh dorsal. Note increased angulation and separation of right ribs and approximation and reduced angulation of left ribs. Distance between spine and periphery of costal cage reduced on right side. Slight compensatory curve to left in lumbar region.

velop the habit of holding the body in a symmetrical attitude. The program of treatment must be carried out over 1 to 2 years to assure the permanency of the cure.

STRUCTURAL SCOLIOSIS

Structural scoliosis though less frequent than the functional type is vastly more important because it signifies the existence of an organic change in the various tissues and not uncommonly grave functional visceral disturbances and psychic imbalance. A structural scoliosis is one in which there is a fixed deformity of the trunk which the patient cannot voluntarily correct. While all of the components of the trunk are involved in this deformity it is described in terms of the abnormality of the spine, the changes of which are the most apparent.

Structural scoliosis has been divided into three grades: mild, moderate and severe according to the degree of deviation and rotation of the vertebrae. The terms employed to describe the scoliosis relate also to the section of the spinal column involved, the direction of the convexity of the curve and the known or likely etiology. For instance one speaks of a moderate paralytic right dorsolumbar curvature, meaning that all or most of the dorsal and lumbar vertebrae are deviated to the right, the curvature is of a moderate degree and has followed an attack of infantile paralysis.

A description of typical examples of structural scoliosis follows.

Right dorsal scoliosis (Fig 1 a). In a posterior view of a patient with this deformity one observes that the right shoulder is higher

than the left. The ribs on the right side project backward. The right scapula is farther away from the midline and is more prominent than the left, its inferior angle projects backward conspicuously. There is a flatness or hollowness of the chest on the left side. The line of the dorsal spinous processes is deviated to the right. There is prominence of the left iliac crest, popularly called the left hip. This prominence may be further emphasized by deflection of the trunk to the right. The lumbar area may be symmetrical but more often the left side is slightly more prominent than the right, due to compensatory deviation and rotation of the lumbar vertebrae to the left. The neck may be symmetrical or the cervical vertebrae may be mildly deviated to the left. In some instances, especially in the severe grades, there may be an increase in the normal backward curve of the dorsal segment causing a kyphoscoliosis. The pelvic and shoulder girdles are usually in the same vertical plane. In some instances in which there is a marked lordosis or exaggeration of the normal lumbar forward curve, the shoulders may be in a plane considerably behind that of the pelvis. In the normal subject a vertical line dropped from the occipital protuberance will pass through the intergluteal fold. In a right dorsal scoliosis the cervical and lumbar vertebrae may remain in the same vertical line or the trunk may be tilted to the right so that the line of the occipital protuberance is 1 to 3 inches to the right of the intergluteal fold. When the patient bends forward the asymmetry of the back and the backward projection of the right ribs becomes exaggerated. Deviation of the spine is best noted in the erect position but rotation of the vertebrae, as evidenced by the backward projection of the ribs on one side, is seen to advantage when the patient bends forward. This fact is important because in instances in which there is only a mild deformity it may not be apparent in the erect position, especially in stout children, but is always and easily recognizable when the individual bends forward. The anterior view of the body will show an opposite deformity of the chest, the right side is flat and the left side prominent. This deformity



Fig 2 Left lumbar curve. Lumbar vertebrae are deviated and rotated to the left, apex at midlumbar area. There is a slight compensatory curve in the dorsal segment, but the chest as a whole is altered but very little.

in a well developed girl in the adolescent period results in unusual prominence of the left breast. Frequently a girl is first brought to us for examination because of a "high hip" or a "big breast."

An anteroposterior x-ray film (Fig 1, b) shows the dorsal segment to be deviated to the right with the apex of the curve about the mid-dorsal vertebrae. The dorsal vertebrae are not only deviated but rotated to the right. It is the rotation of the vertebrae that causes the angulation and backward projection of the ribs. The ribs on the right side have an increased inclination. The ribs on the left side are nearer to one another and flatter and their inclination is markedly reduced. The distance between the spine and the left side of the chest wall is greatly increased. The cervical and lumbar vertebrae

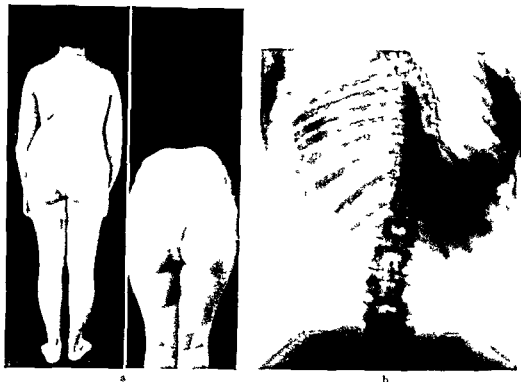


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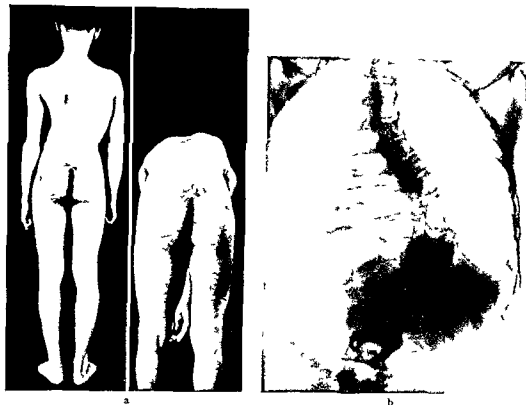


Fig 3 Right dorsolumbar curve a and b Apex of curve at tenth dorsal Marked incurvation of left side of chest and abdomen Note asymmetry of back and backward projection of right ribs

may be in the midline so that the spine looks like a question mark. Usually there is a slight compensatory deviation to the left in both the cervical and lumbar vertebrae. At the apex of the dorsal curve the vertebrae are wedge shaped, the degree depending on the severity of the curve.

The vertical diameter of the trunk is always reduced. In the mild curve this may be of no practical significance. In the severe type the reduction may be very noticeable with conspicuous shortening of the patient's height and telescoping of the chest into the abdomen so that the lower ribs may be very near to, in contact with or even below, the iliac crests.

The thoracic and abdominal organs are involved to a degree commensurate with the severity of the curvature. In the mild cases the lungs, heart, and abdominal organs are so

slightly altered as to give no evidence of it clinically. In the severe grades however, there is marked distortion of the lungs, the heart is displaced, the abdominal viscera are crowded downward toward the pelvis. In this group of cases there may be not only pain in the back but dyspnea on slight exertion and a marked reduction in the capacity for physical exercise.

Left lumbar scoliosis. In a posterior view the most noticeable features are prominence of the left loin with hollowness and incurvation of the right loin. The spine presents a deviation of the lumbar vertebrae to the left with a variable degree of compensatory curve in the dorsal region to the right. The shoulder and pelvic girdles are in the same vertical plane. On palpation there is an abnormal softness in the right loin whereas in the left loin there is an unusual firmness, the fingers

feeling a bony resistance. In an anterior view the most notable feature is an incurvation of the right side of the abdomen with prominence of the right iliac crest.

An anteroposterior x-ray picture (Fig 2) shows a deviation and rotation of the lumbar vertebræ to the left. In the midlumbar region there is wedging of the vertebræ. The extent of the deformity of the vertebræ depends upon the degree of the curvature. There is always some slight deviation of the sacrum to the right. In the severe cases there may be marked distortion of the pelvis, which in the female may be a menace during childbirth.

In a simple lumbar curve the thoracic organs are practically unaffected. The abdominal organs are only slightly affected, since most of them are in front of, and not in intimate contact with, the spine. The liver, spleen, and kidneys placed high up in the abdomen lie over the transitional vertebræ between the thoracic and lumbar segments, in which region there is a minimal deformity. Consequently, they are not affected except in the very extreme cases in which there is marked reduction of the vertical diameter of the abdomen.

Right dorsolumbar curvature (Fig 3, a) When all of the dorsal and lumbar vertebræ are involved in a single curve the apex of the curve is usually at about the tenth dorsal vertebra, the curve beginning at the third or fourth dorsal and terminating at the lumbosacral junction. These curves vary from exceedingly mild in the so called idiopathic variety to extremely severe as is often seen in paralytic deformities. The posterior view will show an exaggeration of the findings of a simple dorsal curve. In the dorsolumbar curve there is often a marked deviation of the trunk to the right. The vertical diameter of the trunk may be reduced so that the right ribs are in contact with the right iliac crest and the left ribs below the left iliac crest, resulting in friction between these parts and pain in the back or abdomen. In an anterior view there is asymmetry of the chest and abdomen. The x-ray picture (Fig 3, b) shows a single curve extending from the upper dorsal region to the lumbosacral



Fig 4 Compound curve, right dorsal left lumbar. The dorsal and lumbar segments are approximately of equal extent and severity. The deviation and rotation elements in each segment are of equal degree.

junction with very mild involvement of the cervical region and rarely a distortion of the sacrum, except in the paralytic cases in which there may be a unilateral contraction of the pelvis or a very severe deformity of the entire pelvis.

Right dorsal left lumbar scoliosis (Fig 4) This is the most frequent of the compound curves. The features of this curve combine those of the simple dorsal and the simple lumbar curves. In the typical right dorsal left lumbar curve the shoulders are usually on the same horizontal plane. The dorsal vertebræ are deviated and rotated to the right. The ribs on the right side project backward and are abnormally angulated. There is lateral compression of the right side of the chest and flatness or hollowness of the left side. There is prominence of the left loin and

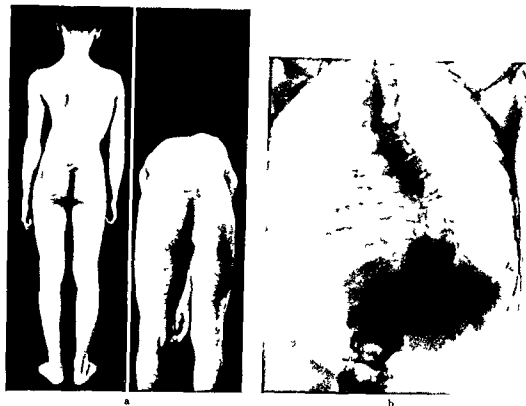


Fig. 3. Right dorsolumbar curve. a and b Apex of curve at tenth dorsal. Marked incurvation of left side of chest and abdomen. Note asymmetry of back and backward projection of right ribs.

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the soft tissues, just as it is, for instance, in torticollis. In a study of 46 cases of congenital scoliosis in infants Harrenstein came to the same conclusion.

Acquired scoliosis There are two groups, a small one in which the cause is recognized and a large one in which there is no discoverable causative factor.

Acquired scoliosis of known cause In the known forms there are scolioses that may be definitely attributed to the following reasonably certain causative agents.

Rickets Rickets by disturbing the nutrition and the growth and shape of the vertebræ may cause scoliosis. Rachitic scoliosis is often severe and resistant to correction. In continental countries, where rickets is more common than in our own, it is said that rickets accounts for about 30 per cent of the cases of scoliosis. In this country, in which there has been a sharp decline in the incidence of rickets, there is only a comparatively small percentage of scoliosis in which rickets can be assumed to be the cause.

Infantile paralysis (Fig 6). This is a comparatively frequent cause of scoliosis. In 1926, reviewing a large number of paralytic cases, I estimated that about 5 per cent developed scoliosis. This was confirmed in a recent review of 221 private cases in which there were 12, or 5 per cent, of paralytic origin. The cause of the scoliosis in this disease is muscle imbalance. It is not uncommon to see, for instance, a right dorsolumbar scoliosis in a paralytic child with paralysis or paresis of the muscles of the right side of the abdomen. Similarly paresis of one leaf of the diaphragm or of some spinoscapular or erector spinæ muscles will result in a spinal curvature.

Lesions of the chest Empyema is a well known cause of scoliosis. The convexity of the curvature is away from the side of the empyema. The curvature is initiated by the persistence of the attitude of deviation of the trunk assumed to relieve discomfort. A single curve is formed with the convexity toward the well side. In a long drawn out illness the deformity may become severe. Recently there has appeared a type of scoliosis which is apparently secondary to the extensive thoracoplasties being performed for pul-

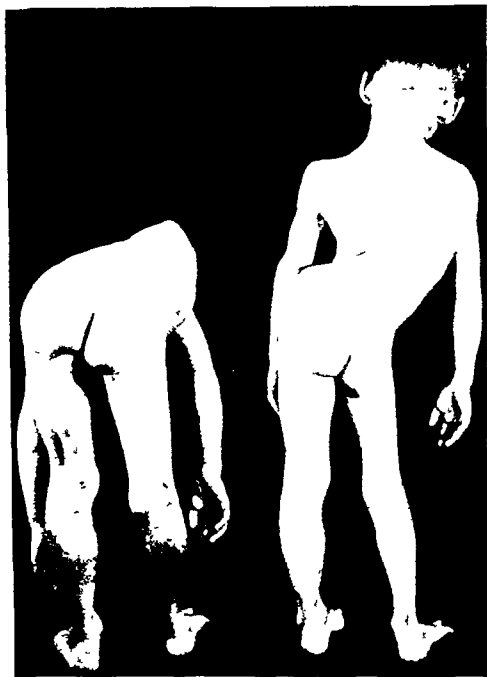


Fig 6 Severe paralytic scoliosis. Note the marked deflection of the trunk to the right and the severe angulation and backward projection of the right ribs. The extensive muscular paresis accounts for the laxity of the tissues of the trunk and lack of voluntary control of posture. This type of scoliosis requires a spine fusion for stabilization of the vertebral column.

monary tuberculosis. The etiology is dependent upon the loss of the bony wall of the chest by removal of some ribs. The scoliosis is always toward the side of operation. The deformity in the adult is mild. In children and in an occasional adult the deformity may be severe. It differs from the ordinary scoliosis in that there is a deviation but hardly any rotation of the vertebræ. Thus in the usual thoracoplasty scoliosis there is lacking the customary backward projection of the chest on the convex side of the curve. In those thoracoplasties in which large fragments of the ribs adjacent to the spine are left, a scoliosis does not develop. Perhaps in the future a satisfactory thoracoplasty will be possible leaving substantial segments of ribs near the vertebræ. To prevent the occurrence of scoliosis following thoracoplasty the operation of resection of the ribs has been combined with a spine fusion.



Fig 5 Congenital scoliosis. Note hemivertebra on left side between tenth and eleventh dorsal vertebrae and on right side between eleventh and twelfth dorsal.

flatness or hollowness of the right loin with prominence of the right iliac crest. When the patient bends forward the asymmetry of the back becomes very evident. This type of curvature varies from the very mild to the severe as do all other curvatures. In an anterior view there is asymmetry of the chest and abdomen. The right side of the chest is flat and the left is convex. In the very severe types of this deformity there may be a telescoping of the chest into the abdomen with diminution of their capacity and functional disturbance of both the intra thoracic and the abdominal organs (Table I).

ETIOLOGY

There are two types of structural scoliosis, congenital and acquired. In the congenital group there are two subdivisions, one in which there is a recognizable deformity of

TABLE I—ANALYSIS OF 221 PRIVATE CASES OF STRUCTURAL SCOLIOSIS

Type of curvature recorded in	Cases	Per cent
Right dorsal	215	
Left dorsal	45	21
Right lumbar	5	
Left lumbar	9	
Right dorsal left lumbar	31	15
Left dorsal right lumbar	55	25 ¹
Right dorso lumbar	4	
Left dorso lumbar	42	19 ¹
Left dorso-lumbar	21	10
Degree of curvature recorded in		
Mild	119	
Moderate	60	30
Severe	87	44
	52	26

one or more of the vertebrae or ribs and the other in which there is no recognizable bony defect.

Congenital deformity with manifest osseous defect (Fig 5). The commonest type is one in which there is an extra centrum or body of a vertebra. This is usually in the form of a wedge that is interposed between two vertebra, causing a lateral deviation of the spine. The next is a wedge formation of a vertebra. The third type is a fusion of part of one vertebra with another forming a wedge mass. The fourth is a spina bifida occulta of varying degree involving one or many vertebra. All of these represent developmental anomalies or defects. They may be present singly or in any combination and involve only one segment of the spine, several segments, or even the entire spine. In the majority of instances the curvature resulting from a congenital scoliosis with a manifest osseous defect is a simple curve and does not advance to an extreme deformation of the entire trunk. When there are multiple defects a severe kyphoscoliosis may result.

Congenital scoliosis without manifest bony deformity. This type is usually seen in early childhood or during infancy. The x-ray pictures show a scoliosis but no abnormal formation of any of the vertebrae. It may be admitted that because of the slight ossification at this early age wedge vertebrae may not be sufficiently clearly outlined to be recognizable. But in many of these cases observed over a period of years it becomes apparent that the primary lesion was a maldevelopment and unilateral contraction of

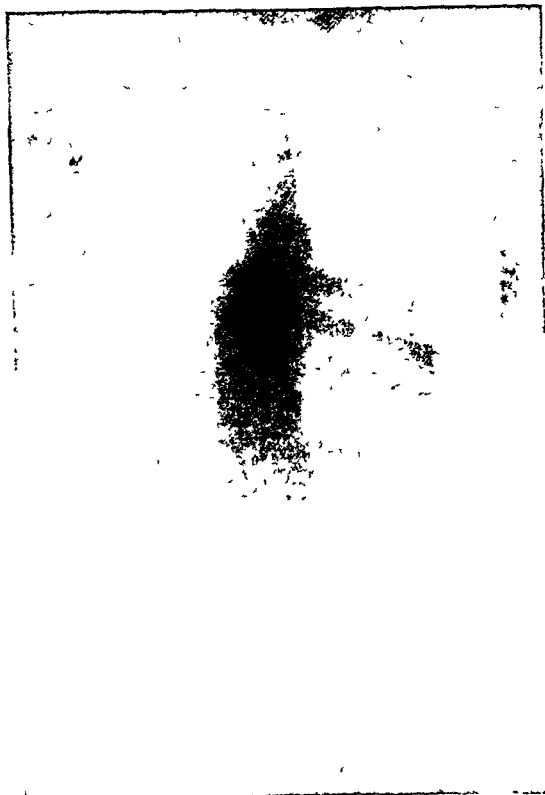


Fig 9 Mild scoliosis Shows effect of corrective plaster jacket a, left Before treatment b, In corrective jacket

Note that there is practically a complete correction of the curvature

formity of the spine In my own practice I have seen a fairly large number of instances in which not only 2 but even 3 and 4 members of a family have had scoliosis In a recent study I found an incidence of 10 per cent of hereditary cases I believe this figure is rather less than the actual because the histories do not always record this detail Parents so often wish to hide the fact that either of them or any relative has a curvature of the spine

Idiopathic scoliosis (Table II) When all of the known causes of the acquired form of scoliosis have been grouped together they form about 30 per cent of the total number of cases In the remainder, or 70 per cent, there is no known cause Consequently they have been grouped under the term of idiopathic, and I believe they must stay in that group until such time as we can identify a definite

cause for all or some of them Some years ago certain schools felt that the vast majority of the acquired scolioses were paralytic in origin I felt then, and I am certain now, that that is not so, for in the majority of in-

TABLE II — ETIOLOGY IN 198 CASES OF STRUCTURAL SCOLIOSIS

	Cases	Per cent
Idiopathic	146	70
Hereditary	21	10
Paralytic	12	6
Congenital	9	4½
Rachitic	2	
Vertebral epiphysitis	1	
Spondylitis	1	
Pleurisy	1	
Dislocation of hip	1	
Arthritis of shoulder	1	
Defective vision	1	
Syringomyelia	1	
Heart disease	1	

This list does not include other well known but infrequent etiological factors



Fig 7 Reduction of curvature by forcible correction and application of plaster of Paris jacket a Photograph of patient with paralytic scoliosis before treatment was instituted b Patient suspended by Sayre halter Note

effect of longitudinal traction this is more marked in paralytic than in idiopathic cases c Application of corrective forces by lateral traction straps d Plaster-of-Paris jacket maintaining patient in corrected attitude

Inequality of the lower limbs A slight disparity in the lower limbs will not cause a scoliosis. When, however, because of disease or deformity of a lower limb there is a marked inequality, with a shortening of an inch or more, there is a deviation of the lumbar spine to the side of the shortened limb with a compensatory curve in the dorsal region in the opposite direction. It does not

necessarily follow that when one leg is shorter than the other a scoliosis will ensue but an inequality of the lower limbs should be compensated during adolescence at least by an appropriate lift in the corresponding shoe.

Defective vision or hearing may cause postures which may initiate a scoliosis.

Torticollis particularly the so called congenital variety is accompanied by a secondary scoliosis.

Neurological disturbances such as syringomyelia, Friedrich's ataxia and spastic paralysis have frequently an associated scoliosis.

Heart disease does not generally cause scoliosis but in the exceptional case in which there has been an enormous hypertrophy of the heart a scoliosis is seen. It is difficult to be certain of the exact mechanism of the pathogenesis of the scoliosis. The important point in this relationship is to appreciate the imperative need to treat the heart condition to minimize its ill effects as that is the best means of controlling the scoliosis.

Hereditary scoliosis In certain families there is a distinct tendency to scoliotic de-



Fig 8 Correction of curvature by traction on a convex frame. Traction obtained through weights. As much as 125 pounds have been used with very little discomfort to the patient. The blow bottles are used several times a day for thorough aeration of lungs.



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Idiopathic scoliosis (Table II). When all of the known causes of the acquired form of scoliosis have been grouped together they form about 30 per cent of the total number of cases. In the remainder, or 70 per cent, there is no known cause. Consequently they have been grouped under the term of idiopathic, and I believe they must stay in that group until such time as we can identify a definite

cause for all or some of them. Some years ago certain schools felt that the vast majority of the acquired scolioses were paralytic in origin. I felt then, and I am certain now, that that is not so, for in the majority of in-

TABLE II—ETIOLOGY IN 198 CASES OF STRUCTURAL SCOLIOSIS

	Cases	Per cent
Idiopathic	146	70
Hereditary	21	10
Paralytic	12	6
Congenital	9	4½
Rachitic	2	
Vertebral epiphysitis	1	
Spondylitis	1	
Pleurisy	1	
Dislocation of hip	1	
Arthritis of shoulder	1	
Defective vision	1	
Syringomyelia	1	
Heart disease	1	

This list does not include other well known but infrequent etiological factors



Fig 10. Severe scoliosis. So called razor back deformity. Spine looks like a reversed question mark. a left. Note short sharp curve with extreme reduction in capacity



of right side of chest. b Satisfactory improvement. Patient was treated on convex frame with traction of 103 pounds.

stances there is no history of an attack of infantile paralysis nor is there any evidence of paralysis of muscles anywhere in the body.

PROPHYLAXIS

Since about 70 per cent of all cases of scoliosis are idiopathic that is of unknown origin there is actually very little one can do to prevent the onset of this deformity. We can however frequently prevent an existing scoliosis from increasing. Therefore if we can manage to get the cases early much can be done to retain the deformity in its mild state.

In an analysis of 221 private cases I found that the age when the deformity was first noticed was mentioned in 179 cases (Table III). Of this number 118 or 65 per cent were between the ages of 10 and 14 years. In many of these perhaps the majority the de-

formity was already well established so that it is reasonable to conclude that the scoliosis had already been in existence for several years. In an additional 27 cases or 15 per cent, the children were under 10 years of age. We may therefore safely assume that in a large majority at least 80 per cent the deformity has its origin between the seventh and tenth years. A little reflection will show that this is the period when children having acquired a measure of independence, being able to bath and dress unassisted are no longer under the careful scrutiny of the mother. Much time even several years may be lost before the existence of the scoliosis is recognized. It is therefore at this age as we now appreciate it that the child must be particularly carefully observed.

The means whereby we may discover a scoliosis in its mild stage are the following

1 Frequent physical examinations This is possible for the pediatricist, who usually has occasion to see every child under his care one or more times a year

2 Stout children in whom the adipose tissue may obscure a mild curvature must be examined especially carefully, for such a child may not show any apparent abnormality in the upright position But if the child is asked to bend forward there will be an easily recognizable asymmetry of the back due to the backward projection of the ribs on the convex side.

3 We should anticipate the appearance of scoliosis in a child who has had an attack of infantile paralysis

4 We must be on the lookout for and correct physical defects that lead to asymmetry of the trunk such as visual or aural deficiency, torticollis, empyema, or an organic neurologic lesion

5 All school furniture should be adjustable so that a child may read and write at his desk in a normal position and without undue muscle strain

6 Particularly careful examination should be made of children in families in which there are some members with scoliosis

7 Prolonged or exhausting illnesses are likely to be followed by muscle weakness and even muscle imbalance which may lead to scoliotic deformity A child, recovering from a prolonged illness, ought not to be allowed to undertake severe mental or physical work until he has regained his normal resistance

TREATMENT

The treatment of structural scoliosis depends upon the age of the patient, the type and the degree of the curvature As will be seen from the figures in Figure 1 the large majority of cases are seen in children Scoliosis in the infant and in the adult constitutes a very special problem and will be taken up separately. In a child the chief factors influencing the mode of therapy are the etiology and the severity of the curvature As most cases are idiopathic this group will receive attention first

Mild idiopathic scoliosis. The primary concern here is to prevent an increase of the de-

TABLE III — ANALYSIS OF 221 CASES OF STRUCTURAL SCOLIOSIS

Private patients examined between 1928 and 1937

	Cases	Per cent
Total number	221	
Males	41	18½
Females	180	81½
Age when deformity was recognized		
Number of cases in which this information was recorded	179	
Years		
0 to 1	3	
1 to 2	1	
2 to 3	5	
6 to 9	18	10
10 to 14	115	64
14 to 16	21	12
18 to 25	14	
34 to 35	2	
Measurement of length of lower limbs		
Total number	110	
Limbs of equal length	102	
Right limb longer than left	7	
Left limb longer than right	1	

formity, for, as previously indicated, if the curve remains mild the patient will have no inconvenience, physical or functional The most effective measure at our disposal to obtain this result is gymnastic exercise Teschner's system of exercises is an excellent one and is used very widely in our country The family and the patient must be impressed with the fact that this method of treatment by gymnastic exercises does not operate rapidly and must be continued over a very long period At times it is helpful to combine with the exercises a light corset of leather or celluloid

Moderate idiopathic scoliosis The aim of treatment in this group is twofold: reduction of the deformity and maintenance of the correction In a general way this is accomplished by the use of corrective and retentive apparatus and gymnastic exercise. Many corrective methods are available Each surgeon should use that procedure with the details of the technique of which he is intimately acquainted The treatment of scoliosis involves very careful attention to detail, it is time consuming, laborious and requires unusual patience on the part of the surgeon who must continuously exhibit a sympathetic and encouraging spirit Few men are temperament-

ally qualified to conduct this treatment. Accordingly only those orthopedic surgeons who are specially interested in, and are willing to devote the necessary care to, the treatment of scoliosis ought to engage in it. A carefully planned and properly applied plaster jacket is an effective modality, while an indifferently applied jacket may actually cause an increase of the scoliosis. Making a good plaster jacket is as much a work of experience and expertness as the performance of a major operation.

Reduction of the curvature. This can be obtained either through a corrective plaster of Paris jacket or by employing traction on a convex frame. The former method is ambulatory and permits the patient to be about and attend school. The latter requires recumbency. The former takes many months of treatment, the latter only a few weeks.

Application of a corrective plaster of Paris jacket (Fig. 7). The patient is suspended by a Sayre halter until his feet lightly rest on the floor. The traction thus employed serves partially to straighten the spine. The shoulder and pelvic girdles are fixed by lateral bands of canvas or flannel. A lateral traction strap is then placed over the convexity of the curve and attached to a bar on the opposite side of the body. As this band is tightened the spine is further straightened. A large removable pad is placed over the concavity of the back from the spine to the anterior axillary line to provide an opportunity for additional correction of the spine. A plaster of Paris jacket is applied. A large window is cut out over the concave side of the curvature. Two small windows are cut out over the convex side through these thick felt pads are inserted every few days. The pads push the spine over to the concave side and increase the correction. A jacket is left on until the maximum improvement in it is obtained. This usually takes an average of 8 weeks. A new plaster jacket is then applied. Additional jackets are applied until the greatest potential improvement or reduction of the curvature is obtained. This usually takes about 6 months.

Traction on a convex frame (Fig. 8). This method is in my experience the simplest the fastest and the most effective means of improving a scoliosis. The patient is placed on

a convex frame. A Sayre halter is adjusted at the head of the bed for traction on the patient's head. A pelvic girdle is applied. On each side of this there is attached a band of webbing which extends to the foot of the bed. To each band is attached a rope going over a pulley and holding a weight for traction on the pelvis. Thus we are able to exert longitudinal traction on the spine. As the patient is recumbent the force of gravity and the superincumbent weight of the body on the spine are removed as deforming elements. Moreover, in the continuous recumbency the muscles relax and the deforming influence of their pull is eliminated. One begins with about 5 pounds of traction on the head and 5 on each side of the pelvis. Each day 1 to 3 pounds are added to each weight, that is, the total pull is increased by from 3 to 9 pounds daily. Lateral traction may be added over the chest at the apex of the convexity. A certain amount of correction is obtained by the attitude of hyperextension and constant pressure on the ribs on the convex side of the curve. In addition expansion of the chest and thorough aeration of the lungs are favored by the use three or four times a day, of blow bottles. In this method the roentgenogram reveals a remarkably rapid change in the spine. Within 4 to 8 weeks the maximum potential improvement in the curvature is obtained. This treatment has only one possible disadvantage viz it is most conveniently carried out in a hospital and therefore it involves the cost of hospitalization and interruption of schooling (Figs. 9 and 10).

When the maximum improvement has been obtained by either the corrective plaster jacket or traction on a convex frame the patient is provided with a corrective or asymmetrical celluloid corset and a long period of gymnastic exercises is instituted. This part of the treatment lasts at least 2 years. Gradually the corset is left off at first for several hours each day later for a day at a time, and finally altogether. The above treatment by either of the corrective measures if carried out uninterruptedly yields satisfactory results in about 80 per cent of the cases. In the remainder in which the deformity increases despite all treatment a

spine fusion operation is advisable in the hope of checking any further increase of the deformity.

Severe idiopathic scoliosis. The cases of severe scoliosis can be divided into those with a stationary deformity and no symptoms and those with increasing deformity with or without symptoms. If the deformity has not increased within several years and the individual has been able to attend to his or her general duties or occupation no treatment is indicated. If, however, the deformity is increasing the treatment should consist of reduction of the curvature as far as may be possible, either through corrective plaster-of-Paris jackets or preferably by traction on a convex frame, followed by a fusion operation on all of the vertebræ in the predominant curve, in the hope that solidification of the spine will stabilize it and prevent further increase of the scoliosis.

Paralytic scoliosis. The most favorable time for treatment is during the early stage when the deformity is very mild. If one can decide just what is causing the scoliosis, as for instance a unilateral abdominal paralysis or a shortened limb, this factor should be corrected by a fascial reinforcement of the paralyzed side or a compensatory lift under the short leg. Support of the back should be applied early and maintained for several or even many years in the hope of preventing increase of the curvature. The tendency in paralytic scoliosis is for the curvature continuously to increase often to a very severe degree with so called razor back angulation of the ribs, telescoping of the chest into the abdomen and marked lateral and antero-posterior distortion of the trunk. With this in mind it is probably advisable to fuse the spine in every case of paralytic scoliosis.

Scoliosis in infants. The deformity is best controlled by placing the infant on a convex frame with mild traction, or, as Harrenstein¹ suggested, by keeping the infant continuously in a corrective plaster-of-Paris bed. The treatment must be carried out for several years until the spine is either straight or only mildly curved. And even then it is probably

advisable for the patient to wear a corset until puberty.

Structural scoliosis, operative treatment. There are two types of operation that are frequently employed in the management of scoliosis, viz., a spine fusion and a rib resection.

Spine fusion. The purpose of a spine fusion is to obtain a consolidation of the vertebræ in the main portion of the curvature, hoping that thereby the curvature of the spine will not increase. All operations are performed on the posterior arches of the vertebræ. Usually only the vertebræ in the main or primary curve are operated upon. Sometimes, as in poliomyelitis, a more extensive operation is advisable. The operative technical details vary in the hands of different surgeons. The most widely used operation is the Hibbs fusion which includes subperiosteal exposure of the posterior arches, bridging of the inter-laminar spaces by segments of bone elevated from the laminae, contacting of the spinous processes, and a removal of the articular cartilage from the intervertebral articulations. I use the Hibbs technique but have modified it by utilizing a beef bone graft which supports the spine in the corrected position while the fusion of the vertebræ is going on and acts as a frame work for the deposition of new bone.

Spine fusion is indicated:

1. In all types of scoliosis in which conservative treatment has failed to control the curvature.
2. In cases in which there is an unequivocal history of progressive increase of the scoliosis.
3. In paralytic scoliosis.
4. In patients with scoliosis who are suffering from persistent and disabling backache.

A spine fusion operation is not a panacea for scoliosis. It is effective in the majority of cases in which it is used. Yet in about 10 or 15 per cent of these cases, even after a spine fusion, the deformity increases. Moreover, the operation is a serious one and therefore should be restricted solely to those patients in whom there is a specific indication and need for it. It is well here to recall that in the vast majority of cases of structural scoliosis, probably in 80 per cent of all cases, conservative treatment is adequate.

¹Harrenstein, R. J. Die Skoliose bei Säuglingen und ihre Behandlung. Ztschr. f. orthop. Chir., vol. 52.

Rib resection This is an excellent operation for reducing the asymmetry of the back. It is used only in those cases in which there is marked angulation of the ribs. It is a cosmetic operation of considerable merit and particularly applicable to girls or sensitive boys. In this procedure one removes about 5 inches from each of 5 or 6 ribs at the crest of the deformity. Often it can be advantageously combined with a spine fusion, the removed segments of the ribs being used as grafts to unite the vertebrae.

SUMMARY

Structural scoliosis or rotary lateral curvature of the spine is a comparatively common deformity. The majority of cases are idio-

pathic that is, of unknown origin, and develop in the pre adolescent period, the deformity progressively increases until the end of adolescence and sometimes even in adult life. The deformity affects not only the vertebral column but all of the osseous and soft tissue structures of the trunk including the viscera. In the advanced forms of the deformity, there may be marked functional disturbances. Some cases remain mild, many advance so that there is a conspicuous distortion of the body, not a few result in extreme deformity of the back. Our chief concern is to discover the scoliosis early since at this stage of its development persistent treatment yields the most effective and satisfactory results.

RENAL FUNCTION TESTS IN THE DIFFERENTIATION OF BRIGHT'S DISEASE FROM SO-CALLED SPECIFIC TOXEMIA OF PREGNANCY

LEON C. CHESLEY, Ph D, Jersey City, New Jersey

THE separation of so called specific toxemia of pregnancy from Bright's disease, *antepartum*, is frequently difficult and sometimes impossible, especially when the patient's history is unknown. Peckham and Stout found that 11 per cent of the Johns Hopkins Hospital toxemia cases were wrongly diagnosed while patients were in the hospital.

Van Slyke and his collaborators (20) in an admirable monograph on Bright's disease, conclude that the signs and laboratory findings of aid in diagnosing renal disease are (a) hypertension, (b) proteinuria, (c) edema, (d) hematuria, and (e) renal functional impairment as shown by tests (urea clearance).

Since pre-eclamptic toxemia fulfills the first four of these five criteria, it seems that the renal function tests offer the best possibility for making the differential diagnosis in cases in which the clinical picture is equivocal.

Will the kidney function tests give normal results in toxemia of pregnancy, thus separating these cases from primary renal disease of measurable degree? This question has been given conflicting answers by different investigators, and can not be regarded as closed.

In the present paper, a large series of cases is analyzed, 5 renal function tests compared, and sources of error considered. Some of the factors responsible for the discordant reports in the literature are discussed.

MATERIAL

With the exception of a very few private cases, every suspected toxemia patient who entered the hospital between January 1, 1935, and July 1, 1936, has been subjected to 5 routine kidney function tests detailed below. Toxemia was suspected if the blood pressure

exceeded 140/90, with or without proteinuria; persistent proteinuria also threw the patient into this class, as did rapid and excessive weight gain associated with toxic symptoms. When the hypertension or proteinuria were observed only during labor, they were, of course, disregarded. By these criteria, the incidence of toxemia was 7.1 per cent.

The eclamptics were observed during 4 years (from January 1, 1934, to January 1, 1938).

The classification of toxemias adopted is somewhat similar to that of Kellogg, Smith, Teel, and Reid. However, patients who showed only hypertension, transient or persistent, were classed as "hypertension" rather than as pre-eclampsia grade 1. Also some patients were not classified.

METHODS

Proteinuria Protein was determined qualitatively by the sulphosalicylic acid method. If the reaction was 1+ or more, a quantitative measurement was made by the method of Shevky and Stafford (17).

Non-protein-nitrogen The blood non-protein nitrogen was estimated by the Wong (17) persulphate digestion and direct nesslerization procedure, the Folin-Wu blood filtrate being used.

Urea nitrogen Van Slyke's gasometric urease method was used for all determinations of blood and urine urea (19).

Phenolsulphonphthalein excretion One milliliter of the dye was injected intravenously. Chapman and Halsted's procedure was then followed. The urine was collected at 15 minute intervals for an hour, and at 2 hours. Water was given freely.

Concentration test Fishberg's simple specific gravity test was used. The patient was allowed no fluid after the 5 00 p m supper.

Rib resection This is an excellent operation for reducing the asymmetry of the back. It is used only in those cases in which there is marked angulation of the ribs. It is a cosmetic operation of considerable merit and particularly applicable to girls or sensitive boys. In this procedure one removes about 5 inches from each of 5 or 6 ribs at the crest of the deformity. Often it can be advantageously combined with a spine fusion, the removed segments of the ribs being used as grafts to unite the vertebræ.

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Concentration test. Fishberg's simple specific gravity test was used. The patient was allowed no fluid after the 5.00 p.m. supper.

From the Department of Biochemistry, Margaret Hague Maternity Hospital

TABLE I—THE NORMAL UREA CLEARANCE IN NORMAL PREGNANCY
From the published data of several investigators and from this series

Author	Antepartum			Postpartum		
	Cases	% per cent	Range per cent	Cases	Mean per cent	Range per cent
Nice	23	121	80-236	13	96	61-120
Canterow and Rockwell	39	73	28-154	3	121	62-124
Dieckmann	27	101	45-175	10	124	15-175
St. John, Ashton and Ladden	4	100	97-110			
Hurwitz and Ohler	5	127	83-161			
Cadden and McLane	6	113		11	104	
Freyberg, Gillard and Ganesbauer	30	106	77-14			
Elden and Cooney	15	85	60-118			
Present series	43	107	80-140	84	113	70-175
Totals and weighted means	188	101	28-236	122	111	51-175

Urine voided during the night was discarded. Specimens were collected at 8 00, 9 00, and 10 00 a. m. The specific gravities were measured by calibrated hydrometers or by weighing. Correction was made for the protein content. No attention was paid to the diet, a vitiating factor which will be discussed below.

Urea clearance. The urea clearance was determined as outlined by Peters and Van Slyke (17). Since many antepartum patients were found to void more urine than could be obtained by catheter, the clearances on these patients were usually done with voided specimens. Postpartum patients still in the hospital were catheterized. Clearances determined in patients back for postpartum study were done with voided specimens. Unless the urine output was in excess of 20 milliliters per hour, third and fourth urines were obtained.

Urea concentration ratio. The blood urea was divided into the concentration of urine urea to obtain this ratio. This was done only when the urine output was less than 60 milliliters per hour.

RESULTS

At the outset, it may be said that the urea nitrogen/non protein nitrogen is almost worthless in diagnosing renal disease of the degree with which we are largely concerned. The 2 hour and fractional phenolsulphonphthalein excretion do not seem to be of much greater value. The specific gravity test is the most

sensitive measure of renal impairment, though unreliable if low results be obtained. The urea clearance is the most generally applicable, the clearance is paralleled by the urea concentration ratio. With all of these tests, except the urea clearance and concentration ratio, subnormal results may—and usually do—mean nothing so far as renal damage is concerned. A low clearance should be checked by one or more repetitions.

Urea nitrogen/non protein nitrogen. Mosesthal and Hiller consider 0.45 as the upper normal for this ratio. Higher values indicate incipient metabolite retention. Many writers have described the decrease in this ratio in normal pregnancy, which means a lower normal than 0.45. The data for the present series have been broken up into several classes, but whatever figure we take as normal, it is evident that abnormal values contribute nothing to the classification of the toxemia. About half of the patients in any group show a ratio above 0.35, while about one third have ratios above 0.40. The ratio tends to be higher in the Bright's disease group, but few values are outside of the range covered by the other toxemias. Postpartum the ratio increases in all groups.

Two hour phenolsulphonphthalein excretion. Three fifths of the nephritics so diagnosed showed subnormal excretion of phenolsulphonphthalein antepartum (60 per cent is considered as normal). The interpretation of

the low excretion is complicated by the fact that 30 per cent of the patients in the normal, pre-eclamptic, or hypertensive groups have a comparably low excretion antepartum. Postpartum about 1 in 7 of these latter patients fail to excrete as much as 60 per cent of the dye. Thirty-seven per cent of the nephritics give subnormal results after delivery. The range of amounts excreted is similar in all groups, which means that the test is of no value in differential diagnosis.

Fifteen minute phenolsulphonphthalein excretion. Chapman and Halsted pointed out that the amount of dye excreted in the first 15 minutes after intravenous injection is a more sensitive renal function test than the determination of the 2 hour total. The fractional phenolsulphonphthalein has been measured in only 67 antepartum and 121 postpartum patients, but some conclusion seems warranted. To conserve space, only the excretion for the first 15 minutes will be considered. This fractional excretion of phenolsulphonphthalein is open to the same objection as is the 2 hour test. Here the shortcoming is even more pronounced. More than half of all antepartum and one-fourth of all postpartum patients fail to excrete as much as 26 per cent of the dye. This applies also in the normal control group. Postpartum the nephritic group as a whole excreted more dye than even the normals. (This failure of excretion is often apparent rather than real, as will be pointed out.)

Specific gravity test. Alving and Van Slyke have compared the sensitivity of concentration tests with that of the urea clearance. They found such rigorous tests as the Lunds-gaard or Lashmet-Newburgh to be more delicate indicators of renal impairment than the clearance. As we shall see, this also applies in toxemias of pregnancy, although the concentration test used here does not always give reliable results.

Here, as with the phenolsulphonphthalein tests, so many patients (about half) in all groups show subnormal values that the interpretation of a low result in an individual case becomes practically impossible. As a group, the nephritics show much poorer concentrating power than any other group.

Stander, Ashton, and Cadden report that

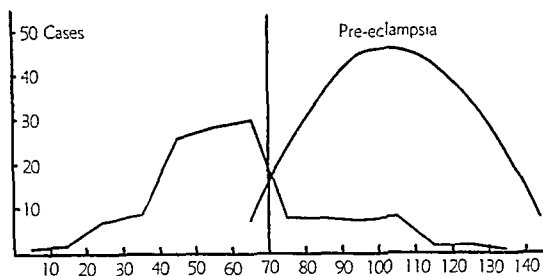


Fig 1 The distribution of urea clearances in Bright's disease and pre-eclampsia (grade I). Most clearances in the former group are less than 70 per cent, while practically all clearances in the pre-eclamptics are normal.

the Mosenthal test is of no value in the differential diagnosis of toxemias.

Urea clearance. Van Slyke originally set the normal range of the urea clearance at 80 to 120 per cent. Bruger and Mosenthal suggest 75 per cent as the lower normal limit, 50 to 75 per cent as doubtful, and below 50 per cent definitely abnormal. There is some disagreement as to the effect of normal pregnancy upon the urea clearance. Some of the published data are condensed in Table I. With the methods used in this study, the normal clearance appears to be about the same in late pregnancy and puerperium as outside of pregnancy. However, very high clearances are sometimes seen immediately postpartum and the range seems to be wider than antepartum. Perhaps these higher clearances are attributable to the nitrogen arising from the involuting uterus; high protein intakes are known to increase the clearance, especially after a low protein regimen.

The urea clearances found in pre-eclampsia (grade I) and in Bright's disease complicated by pregnancy are shown in Figure 1. It may be seen at a glance that a differentiation between the two is usually possible by means of this test alone. A mild nephritic may, however, show a normal urea clearance. In such a case the test is useless for diagnosis. The urea clearance findings for all groups are summarized in Table II.

Only in the nephritic group does one find many clearances below 70 per cent (the lower normal suggested by Cadden and McLane and accepted here). The clearances in the pre-eclamptics, eclamptics, and hypertensive pa-

TABLE II—THE UREA CLEARANCE IN NORMAL AND TOXIC PREGNANCY AND PUERPERIUM

The standard deviation was calculated as $\sqrt{\frac{\sum f(x^2)}{N}}$

Group	Cases	Mean per cent	Med an per cent	Mode per cent	Standard deviation per cent	Range per cent
Normal antepartum	43	10	107	105	22.1	60-148
postpartum	84	112	113	112	22.7	70-173
Eclampsia antepartum	10	94	96		19.0	50-125
postpartum	50	66	61	68	25.0	34-147
Pre-eclampsia Grade II antepartum	7	98	99		12.7	44-156
postpartum	17	97	94		17.5	70-153
Pre-eclampsia Grade I antepartum	112	101	10	105	10.4	60-147
postpartum	147	108	98	95	18.6	60-180
Hypertension antepartum	67	107	106	103	18.2	70-165
postpartum	86	108	106	108	17.7	70-150
Chronic antepartum	38	105	104		21.5	80-148
postpartum	47	105	105	103	18.9	54-155
Bright disease antepartum	33	50	33	6	20.4	20-114
postpartum	37	61	50	55	6.1	20-111

tients vary around 100 per cent and do not differ significantly from the normal controls. The mean, median, and mode for the nephritics lie at about 60 per cent, which is significantly low.

In all groups the higher or highest clearance of several shown by a patient was taken as that individual's functional level if certain conditions were fulfilled. If the highest clearance was not checked by a high urea concentration ratio the average of the two or three highest findings is recorded. If the high clearance were obtained with a blood urea nitrogen which gave a urea nitrogen non protein nitrogen ratio below that usually shown by the patient the clearance was disregarded. Clearances of the first and second hours were required to check within 15 per cent. They were not considered if calculated from urine volumes of less than 20 milliliters per hour.

Urea concentration ratio. The urea concentration ratio parallels the urea clearance, when the ratio is calculated from low urine volumes. The parallelism is shown in Figure 2 which summarizes the downward course of a patient observed for 10 months. The urea concentration ratio has the same significance as the clearance itself and often serves as a valuable alternative. The advantage of the

clearance is that it can be calculated from any urine volume above 20 milliliters per hour, the urea concentration ratio must be calculated from low volumes.

Comparison of tests. The urea clearance and the specific gravity (concentration) tests are compared in Figure 3. The distribution of urea clearances is plotted for all 503 patients showing a specific gravity of 1.020 or higher. Ninety seven per cent of these clearances are above the lower normal limit of 70 per cent. Of the 3 per cent—14 cases—several clearances are single determinations and are possible low variations. Four are antepartum clearances in patients who showed normal clearances postpartum. The conclusion to be drawn from the figure is that the clearance will very probably be normal until the attainable specific gravity falls below 1.020. With more rigorous concentration tests the specific gravity limit would be higher. Alving and Van Slyke found the limit to be 1.026 in the Lashmet-Newburgh test. The specific gravity test is, therefore, a more sensitive test for the detection of renal impairment than is the urea clearance. As already mentioned however the usefulness of the test is definitely limited in that low results are usually referable to extrarenal factors.

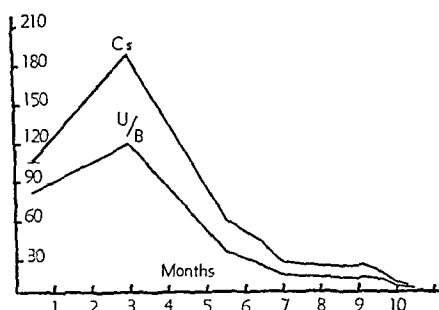


Fig 2 Parallelism of the urea clearance (Cs) and the urea concentration ratio (U/B). Observations on a case of Bright's disease followed from the beginning of measurable renal impairment to death in uremic acidosis

Figure 4 compares the 15 minute phenolsulphonphthalein excretion with the urea clearance. All patients excreting more than 26 per cent of the dye in the first 15 minutes are represented. About one-fifth of these have subnormal urea clearances. Of the other four-fifths, many would have normal renal function by any test. From this graph we may conclude that the urea clearance is considerably more sensitive than the 15 minute phenolsulphonphthalein

The other tests, having been shown to be of little value in the toxemias of pregnancy, will not be considered here

EVALUATION

Sequence of tests Since the concentration test is the most sensitive of all studied, there would be no indication for doing the others if the toxemia patient should show a specific gravity above 1.022 or even 1.020. This is fortunate, since this is the simplest test of all and may be performed by the practitioner in his own office

Sources of error About two-fifths of the patients failed to concentrate to 1.022. Alving and Van Slyke have shown that about three-fourths of the specific gravity of urine, above 1.000, is given by salts of which chlorine makes one-third. Urea contributes much to the rest of the significant specific gravity. The quantities of these substances available for excretion are governed by the dietary intake. If the salt and protein be restricted, the urine can not show so high a specific gravity as it otherwise would

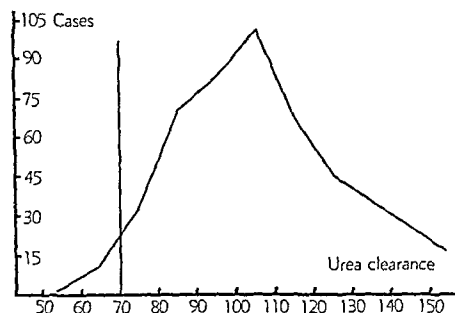


Fig 3 The distribution of urea clearances in toxemia patients (all groups) who were able to attain a urinary specific gravity of 1.020 or higher. All but 2.8 per cent of the 503 cases had urea clearances of more than 70 per cent

Most of these toxemia patients had been on a low-salt diet for days or even weeks before some of the concentration tests were done. Many were on a low protein intake as well. Still a third factor which will reduce the attainable specific gravity is the dilution of the urine by edema fluid, which is found in many toxemia patients. These factors will also reduce the attainable specific gravity of the urine in normal subjects. The control series of normal pregnant women were kept on this diet for 2 or more days before the concentration test was done. As was seen above, nearly two-thirds of antepartum and two-fifths of postpartum normals failed to concentrate to 1.022.

As for the phenolsulphonphthalein tests, there is a remarkable uniformity in the proportion of patients failing to excrete the normal amount of dye (52 to 60 per cent in each group). This suggests a common factor. One consideration is undoubtedly the dilated



Fig 4 The distribution of urea clearances in toxemia patients (all groups) who had a 15 minute phenolsulphonphthalein excretion of '26 per cent' or more. One-fifth of these patients had urea clearances of less than 70 per cent

TABLE III.—UREA CLEARANCES FOUND IN THE FOLLOW UP OF PATIENTS DIAGNOSED AS NEPHRITIS ON THE BASIS OF LOW UREA CLEARANCES ANTEPARTUM OR IN PUERPERIUM

Hypertension proteinuria and edema persistent

Antepartum per cent	Puerperium per cent	6 wks per cent	3 mo per cent	6 mo per cent	1 yr per cent	2 yrs per cent	Remarks
41	50	6	15	Dead			Uremia 2 mo postpartum
30	40		Dead				Uremia 3 mo postpartum
37	24	13	Dead				Uremia 3 mo postpartum
61	60			Dead			Uremia and cardiac
35	Dead						B high nephrosclerosis
28	40	50		51		Dead	Uremia
49	30		25				Severe hypertensive
	65			61			Anemia subjective
	8	21	37	35	50	46	History
	67	63		57	45		Subjective
33	21	43	34	55	61	56	Subjective
64					39	31	Hemat in subjective
	35			4	46	32	Eclampsia twice
	34		45		46		Eclampsia
	63				53		Gross proteinuria
	65	57	69	69	45		Subjective
60	57				64	34	Subjective
64	60			54			Subjective
30	3		4	8			Subjective
45	47			84		77	Hemat in

Hypertension and proteinuria persistent

37	60		49	35			Hemat in
45	59	53	49	34	32		Severe hypertension
	17		4				Hemat in
	0					60	Hemat in
5	67	60					Hemat in
53	51			43			Hemat in subjective
49	40	45	41	64			Repeated hematuria
51	37			5	3	5	Chronic nephritis
58	11			40			No complications
53	8		39	35			No complications
61	66			57			Severe hypertension

Proteinuria persistent

	56			64			No complications
64				6	64		Eclampsia
	41	5	3	6			No complications
34	47	59	4				Eclampsia high blood pressure
61	60	67	69				Eclampsia

TABLE III—UREA CLEARANCES FOUND IN THE FOLLOW UP OF PATIENTS DIAGNOSED AS NEPHRITICS ON THE BASIS OF LOW UREA CLEARANCES ANTEPARTUM OR IN PUERPERIUM—Continued

Neither hypertension nor proteinuria persistent

Antepartum per cent	Puerperium per cent	6 wks per cent	3 mo per cent	6 mo per cent	1 yr per cent	2 yrs per cent	Remarks
	60					38	Hematuria, edema
44		45	59	58	45	60	History, hematuria
44	48	27		43	54		Chr pyelonephritis
	45	58		69			Repeated toxemia
66	63	34		49			No complaints
	66			69			History, subjective
	43			56	62		No complaints
68	68	69			94		Repeated toxemia
	45			32	38	32	Occasional proteinuria, edema
46	43				37	45	Hematuria, anemia

ureters which cause a lag in the appearance of an excreted foreign substance in the bladder

The standard urea clearance can not be calculated from urine volumes of less than about 20 milliliters per hour (Chesley, 6, 7). This has apparently been a source of error in several publications. For instance, Dieckmann routinely did urea clearances on urine specimens obtained during a concentration test. Many of these urine volumes were below the critical limit of 20 milliliters per hour; since the fundamental assumption on which the standard clearance is calculated does not hold for this range of volumes, he did not really calculate urea clearances. This is probably enough to account for his finding that the "urea clearance" averaged about 50 per cent in all toxemic patients, and for his conclusion that the "urea clearance is of little value in pregnancy in the majority of cases as an aid in diagnosis or prognosis." Even without this consideration, Dieckmann's results do not appear convincing. For instance, from his Table V it seems that the urea clearance is less than 39 per cent in two-thirds of toxemic multiparæ having no history of toxemia. One-fourth of this group had clearances of less than 19 per cent. Yet the blood urea values were normal, the mean for this group being 15.4 ± 0.74 .

Several investigators have reported low urea clearances in eclampsia. None of these gives actual urine volumes or makes any mention of

the vitiating factor of oliguria. Hurwitz and Ohler do say that a clearance of 8 per cent was observed in an eclamptic who was almost anuric. They also comment upon the rapid rise in urea clearance as the toxemia regresses (and therefore as the oliguria clears). In the present series, urea clearances were done antepartum or immediately postpartum in 68 eclamptics. Only 4 of these clearances were less than 70 per cent. Three of the 4 patients have been shown in the follow-up to have a measurable and probably permanent renal impairment. In all of the 68 cases, the clearances were calculated from urine volumes of more than 20 milliliters. The use of smaller volumes on the same day gave erroneous calculations in accord with some of the published data mentioned above.

The urea clearance in differential diagnosis. The data presented here seem to show that the urea clearance will often differentiate Bright's disease complicated by pregnancy from so called specific toxemia. Bright's disease as used here is a very general term which includes glomerular (hemorrhagic) nephritis, pyelonephritis, advanced benign and malignant nephrosclerosis, and even one known case of polycystic kidney. In short, any renal impairment of measurable degree has been called Bright's disease. Following a bad obstetrical precedent, "nephritis" has been occasionally used as a synonym. Cases conforming to the usual criteria for Bright's

disease, before the pregnancy, have been included though in some no renal impairment was shown by the tests used. An effort has been made to differentiate cardiovascular hypertension without functionally detectable nephrosclerosis. In many cases, the follow up has resulted in changed diagnoses.

In how many cases diagnosed as nephritis by the urea clearance can the diagnosis be sustained? The value of the test stands or falls on the answer to this question.

During the 18 months from January 1, 1935, to July 1, 1936, urea clearances of less than 70 per cent were observed in 119 patients. In 42 of these cases, no effort was made to follow up the patient's renal function because the test was not regarded as significant for one or more of several reasons. In many instances, immediate repetition of the clearance gave normal values, indicating that the one reading below 70 per cent was a low variation in a normal kidney. If a single clearance was done, and this was less than 70 per cent the clearance was disregarded if the specific gravity of the urine exceeded 1.022 or if the urea concentration ratio was above 70.

Five other cases with urea clearances of less than 70 per cent have been thrown out because these patients had acute pyelonephritis from which they have apparently recovered.

This leaves 72 cases with low clearances. Of these, 20 could not be followed up for various reasons. The 52 remaining cases have been followed for periods up to 3 years.

In Table III are shown the results of the follow up study in 48 cases. In all but 2 of these, urea clearances have continued at a low level for as long as the patient was observed (to date). Both hypertension and proteinuria have persisted in more than half. Of the 4 cases not shown, it is considered that the diagnosis of nephritis is justified by the history in 2 cases. One other case had a nephropexy at 7 months postpartum; the granular kidney observed at that time plus a mild hypertension and proteinuria are enough to confirm the diagnosis here. In the other, urea clearances were not obtainable in the follow up but moderate hypertension (190/110) gross proteinuria, edema, hematuria and final death in uremic acidosis were taken as proof of renal disease.

Six of the patients are dead. Five died in uremic acidosis, and the sixth of heart failure.

SUMMARY AND CONCLUSIONS

1 Renal function has been studied in 599 cases of toxemia of pregnancy. A control group of 119 patients was also studied. The tests used were the urea nitrogen/non protein nitrogen, the 2 hour and the fractional excretion of intravenous phenolsulphonphthalein, the Fishberg concentration test, the urea clearance, and the urea concentration ratio.

2 The toxemias were classified as follows: eclampsia, 79 cases, pre eclampsia grade I (mild), 217 cases, pre eclampsia grade II (severe), 20 cases, hypertension, 125, unclassified, 67, and Bright's disease, 91.

3 The urea nitrogen/non protein nitrogen, the 2 hour, and fractional phenolsulphonphthalein excretion tests are apparently not very sensitive and are influenced by several extrarenal factors. They are not of much value in differentiating nephritis from so called specific toxemia of pregnancy.

4 The specific gravity test is the most sensitive studied. If the specific gravity should be as high as 1.022, there is apparently no indication for doing the other tests, which would all be normal—except for extrarenal factors.

5 Many patients, even without toxemia, will fail to concentrate to 1.022 when salt and protein of the diet are restricted.

6 The urea clearance is the most generally applicable of all tests studied. The level in normal pregnancy is about the same as out of pregnancy.

7 In eclampsia, pre eclampsia, and hypertension the urea clearance does not differ significantly from values observed in normal patients.

8 In Bright's disease complicated by pregnancy, the clearance is often less than 70 per cent. This differentiates renal disease of measurable degree from specific toxemia of pregnancy.

9 The urea concentration ratio parallels the urea clearance, and at very low urine volumes is a valuable alternative.

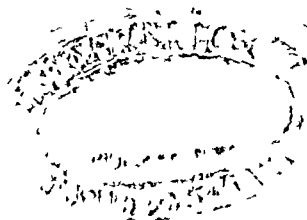
10 Some contradictory results in the literature especially regarding urea clearance findings are discussed.

11 A follow-up of patients having urea clearances of less than 70 per cent shows that the function does not improve. In most cases hypertension or proteinuria or both persist. Edema and hematuria are often found. Therefore, diagnoses of Bright's disease made on toxic patients showing lowered clearances are justified.

I am greatly indebted to Drs S A Cosgrove, J F Norton, and E G Waters for reading and criticizing the manuscript. Most of the patients were on the services of these men. The majority of the blood non-protein nitrogen determinations were done by Miss P Brett, while most of the phenolsulphonphthalein and concentration tests were done by the Misses M Wolfe and F Orsato. The attending, house, and nursing staff have co-operated throughout.

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THE BLOOD VOLUME AND HEMOGLOBIN AFTER TRANSFUSION

WILLIAM L. SIBLEY, M.D., and JOHN S. LUNDY, M.D. Rochester, Minnesota

IN an early paper, Boycott and Douglas showed that the blood volume of rabbits following transfusion apparently returned to the pre transfusion level the next day after the transfusion. However, in a later work, Boycott and Oakley found that when they corrected the figure for blood volume there occurred an increase in the blood volume of the rabbits that were transfused which was practically equivalent to the cell volume of the blood given as a transfusion. This indicated that the plasma volume tended to remain at a constant level and the changes that occurred in the blood volume depended on the changes in the cell volume of the host. That the plasma volume remains constant under varying conditions has been demonstrated by Rowntree, Brown and Roth and by Bock.

Working on rabbits Boycott and Oakley found, also, that the value for total hemoglobin was at a lower level than it had been calculated to be 24 to 72 hours after transfusion. Essentially the same condition was found to exist by Krumbhaar and Chanutin who produced experimental plethora in animals by repeated transfusions. These two groups of investigators found that the value for hemoglobin after transfusion was never so great as it was calculated to have been and that some of the hemoglobin was lost from the circulation after transfusion.

It has been demonstrated that reactions to blood transfusion produce a deleterious effect on the otherwise beneficial effects of blood transfusion on the content of hemoglobin in the blood of the recipient (9). At the time of the study of the effects of reactions on the concentration of hemoglobin of the blood following transfusions certain data were obtained which allowed calculation of blood volume

of the recipients of those transfusions. The effects of transfusion on the blood volumes of the recipients thus were determined. At the same time, the changes in the values for total hemoglobin were observed.

METHOD

All transfusions, in this work, were given by the citrate method of Lewisohn, as described by Lundy, which is the routine method of blood transfusion at the Mayo Clinic. Each transfusion consisted of 500 cubic centimeters of blood and 110 cubic centimeters of physiologic solution of sodium chloride and sodium citrate, making a total of 610 cubic centimeters of fluid. The 610 cubic centimeters of blood, saline and citrate were administered in a period of 30 minutes at each transfusion.

All hemoglobin determinations were made on the Cenco Sheard Sanford "photometer." The technique for determining the value of hemoglobin was applied as described by the inventors of the photometer (8). The concentration of hemoglobin of the donors was determined at the time that the blood was being withdrawn for transfusion. The concentration of hemoglobin of the recipients of the transfusions was determined immediately before transfusion, 3 minutes after transfusion and, again at the end of the first, second, fourth, sixth, eighth, and tenth days after transfusion.

Data concerning body weight were available in 84 cases. Knowledge of body weight made it possible to estimate the blood volume of these 84 patients using the figure 81.8 cubic centimeters of blood per kilogram of body weight (the blood volume of 81.8 cubic centimeters is the average volume per kilogram of body weight given by Rowntree, Brown and Roth).

The total volume and the total content of hemoglobin of each transfusion being known

TABLE I—VALUES FOR HEMOGLOBIN AND CHANGES IN BLOOD VOLUME AFTER BLOOD TRANSFUSION, NINETY-NINE CONSECUTIVE CASES, GENERAL RUN OF CASES, AVERAGE MEAN VALUES

	Before transfusion	After transfusion						
		3 minutes	1 day	2 days	4 days	6 days	8 days	10 days
Value for hemoglobin, gm per cent	9.40	10.00	10.70	10.90	10.50	10.90	10.30	10.30
Increase in value for hemoglobin, gm per cent		0.60	1.30	1.50	1.10	1.50	0.90	0.90
Increase in total hemoglobin, gm (calculated)		77.8	77.8	86.6	68.9	86.6	50.2	50.2
Total hemoglobin, gm (calculated)	392.9	470.7	470.7	479.5	461.5	479.5	443.1	443.1
Blood volume, c cm	4,167	4,695	4,399	(gain 232 c cm)				

it was possible to calculate the approximate amount of change in the volume of blood of the recipient of such a transfusion. In this group of 84 cases, it was found that, in the period of 30 minutes required to administer each transfusion, approximately 82 cubic centimeters of fluid disappeared from the circulation of the recipients of this mixture of 610 cubic centimeters which included blood, saline and citrate. Consequently, for the benefit of accuracy, it was necessary to subtract this amount of 82 cubic centimeters from the total volume of 610 cubic centimeters added with each transfusion, because the second determination of concentration of hemoglobin was not made until all the blood was run into the vein of the recipient. This means that the blood volume of the recipient at the end of the transfusion of the 610 cubic centimeters actually was increased by only 528 cubic centimeters.

The concentration of hemoglobin at the various intervals of observation having been determined and the volume of fluid added by each transfusion having been established as 528 cubic centimeters, it was possible to calculate, in the following manner, the total volume of blood of patients being transfused.

Let v = the blood volume before transfusion

Let y = the value for total hemoglobin before transfusion

Volume \times concentration = total amount, then

$(x) \times \text{concentration} = y$

or

$\frac{y}{x} = \text{concentration}$

and after blood transfusion

$\frac{y + \text{gm hgb added}}{x + \text{volume of transfusion}} = \text{new concentration}$

Example:

concentration hgb immediately before transfusion = 094 gm / c cm

concentration hgb immediately after transfusion = 100 gm / c cm

total hgb added by transfusion = 77.8 gm

total (corrected) volume of transfusion = 528 c cm

substituting in the formula

$$\frac{y}{x} = 0.094 \div y = 0.094x$$

and

$$\frac{y + 77.8}{x + 528} = 0.100 \div \frac{0.094x + 77.8}{x + 528} = 0.100$$

then

$$0.094x + 77.8 = 0.100x + 52.8$$

or

$$0.006x = 25$$

$$x = 4167$$

Therefore, the blood volume before transfusion was 4167 c cm

Again,

$$y = 0.094x \div y = 0.094 (4167)$$

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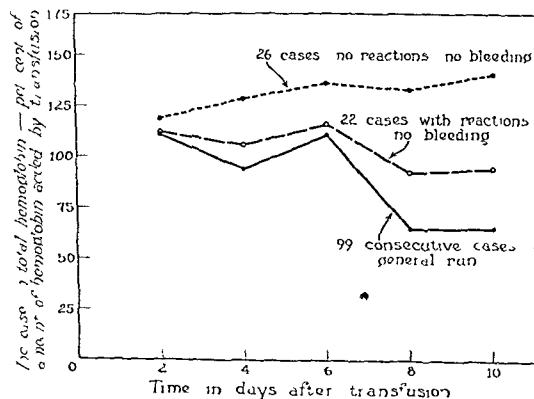


Fig 1 Graphic illustration of comparative results in three groups of cases studied

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and

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then

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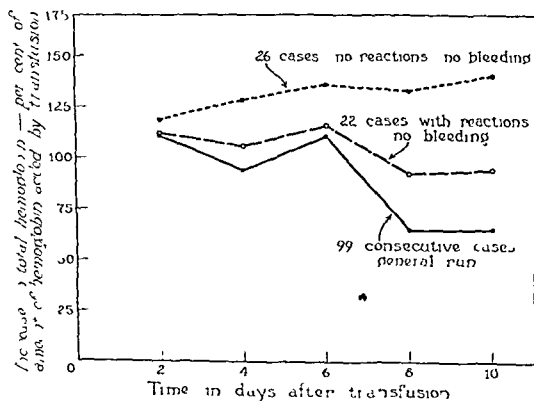


Fig 1 Graphic illustration of comparative results in three groups of cases studied

TABLE II—VALUES FOR HEMOGLOBIN AND CHANGES IN BLOOD VOLUME AFTER BLOOD TRANSFUSION TWENTY TWO CASES REACTIONS TO TRANSFUSION NO BLEEDING AVERAGE MEAN VALUES

	Before transfusion	After transfusion						
		3 minutes	1 day	2 days	4 days	6 days	8 days	10 days
Value for hemoglobin gm per cent	8.44	9.41	9.41	10.04	9.94	10.14	9.51	9.57
Increase in value for hemoglobin gm per cent		0.97	1.00	1.60	1.50	1.70	1.00	1.13
Increase in total hemoglobin gm (calculated)		94	94	104.8	100.3	100.7	82	83.8
Total hemoglobin gm (calculated)	144.6	438.6	438.6	443.4	444.9	445.3	416.6	415.4
Blood volume c cm	408.1	467	467	(441.40 c cm)				

Therefore the value for total hemoglobin before transfusion was 392.9 gm

The blood volume immediately after transfusion was, thus,

$$4167 + 528 = 4797 \text{ c cm}$$

and the value for total hemoglobin immediately after transfusion was

$$392.9 + 77.8 = 470.7 \text{ gm}$$

Thus having established certain facts about the blood volume and the value for the hemoglobin of the recipient's circulating blood, it was then a matter of determining changes in concentration in order that the changes in blood volume in the next 24 hours could be calculated, for example

Let x = the new blood volume

$(x) \times \text{concentration} = \text{total amount}$

The total amount of hemoglobin = 470.7 gm

The new concentration = 0.107 gm/c cm then

$$(x) \times 0.107 = 470.7$$

$$x = 4399$$

Therefore, the blood volume at the end of 24 hours was 4399 cubic centimeters. This represents a loss of 306 cubic centimeters of the volume of 528 cubic centimeters added by transfusion, or a gain of 232 cubic centimeters in the total blood volume of the recipient by transfusion. This gain represents approximately the cell volume of 500 cubic centimeters of blood of the average person. The results of these observations and calculations are expressed in Tables I, II and III and Figure 1.

OBSERVATIONS

The behavior of the blood volume and hemoglobin in a group of 99 persons following transfusion of 500 cubic centimeters of citrated blood is expressed in Table I. In this table it

is seen that the blood volume was calculated to be 4,167 cubic centimeters before transfusion. Twenty-four hours after the transfusion it was found to be 4,399 cubic centimeters. This change represents a gain of 232 cubic centimeters in total blood volume, which is equivalent to 46.4 per cent of the volume of the blood added. This means that the volume has increased in an amount exactly equivalent to the cell volume contained in 500 cubic centimeters of blood of the average normal person. This same table illustrates also that the total hemoglobin apparently increased by an amount equal to that added in the transfusion. This gain was maintained for several days and dropped off to almost half the amount gained by transfusion. This drop is undoubtedly owing to bleeding and to reactions following transfusion as will be evident on examination of Tables II and III.

Table II depicts the behavior of the hemoglobin and the changes in the blood volume following transfusion of 500 cubic centimeters of citrated blood in a group of 22 persons in whom no bleeding was evident but who did have reactions to transfusion. A reaction was said to have occurred when the patient had chills and elevation of temperature above normal to at least 100 degrees F (37.8 degrees C) or higher. This table illustrates that the blood volume had increased 392 cubic centimeters by the end of the first day after transfusion. This was 70 per cent of the volume of the blood added by transfusion. Apriori we would expect this to increase approximately 48 per cent of the 500 cubic centimeters volume of the blood added by transfusion. The probable reason why the blood volume, in this instance

TABLE III—VALUES FOR HEMOGLOBIN AND CHANGES IN BLOOD VOLUME AFTER BLOOD TRANSFUSION, TWENTY-SIX CASES, NO REACTIONS AND NO BLEEDING, AVERAGE MEAN VALUES

	Before transfusion	After transfusion						
		3 minutes	1 day	2 days	4 days	6 days	8 days	10 days
Value for hemoglobin, gm per cent	8.75	9.55	10.04	10.43	10.65	10.61	10.75	10.87
Increase in value for hemoglobin, gm per cent		0.80	1.29	1.68	1.90	2.06	2.00	2.12
Increase in total hemoglobin, gm (calculated)		79.7	79.7	94.2	102.3	108.2	106.1	110.6
Total hemoglobin, gm (calculated)	293.3	373	373	387.5	395.6	401.5	399.4	403.9
Blood volume, c cm	3,363	3,891	3,715	(gain 352 c cm)				

remains at such a high level of increase after transfusion is that there were several transfusions of polycythemic blood having a concentration of hemoglobin of as much as 22.7 grams per cent. The cell volume was not determined but it is reasonable to assume that it was high for this group. Also, Table II illustrates that the content of hemoglobin of the recipient increased slightly for several days above the amount added by transfusion, but by the end of the eighth day it had decreased to a point below the amount added by the transfusion and remained at that level. This represents a loss of about 10 per cent of the amount of hemoglobin added by transfusion.

Table III reveals the nature of the changes that occurred in the blood volume and in the behavior of the content of hemoglobin of the blood of the recipients of transfusions who did not give evidence of reaction to transfusion or signs of bleeding after transfusion. This table illustrates that the volume of blood increased 352 cubic centimeters which is 66 per cent of the volume of the blood transfusions. The total hemoglobin of the blood of the recipients increased in a constant progressive manner above the amount added by the transfusions for the period of 10 days during which the amount and concentration of hemoglobin of these patients were followed. At the end of the tenth day after transfusion, the value of hemoglobin of the recipients in this group had increased 40 per cent above the amount added by the transfusion.

Comparing the results in the three tables it is seen that the blood volume increased, in each instance, to a point approximately equivalent to the cell volume of the blood added by transfusion. Also, these tables illustrate that

the values of total hemoglobin after transfusion behaved according to the conditions that existed after the transfusion. Thus, it was observed that, if bleeding and reactions occurred after transfusion in the general run of cases, the value for hemoglobin increased to an amount about equal to that added by the transfusion, only to decrease to 65 per cent of the amount added by the transfusion at the end of the eighth day. If reactions occurred after transfusion and bleeding did not occur, the total hemoglobin increased above the amount added by transfusion until the eighth day, at which time it decreased to 89 per cent of the amount added by transfusion. If both reaction and bleeding did not occur, the total hemoglobin increased progressively until the tenth day, at which time it was 40 per cent above the amount added by transfusion. Also, the increase in total hemoglobin of the group of patients who had no reactions was 50 per cent more than the increase shown on the tenth day by the patients who had reactions (For comparison, see Figure 1).

SUMMARY

The method of calculating blood volume has been explained and examples have been included.

It was found that, among human beings who have secondary anemia, the blood volume increased in an amount approximately equivalent to the cell volume of the blood added by transfusion.

Among human beings who have secondary anemia, the total hemoglobin after transfusion apparently increases above the amount added by transfusion during the 10 day period following blood transfusion, provided that there

has been neither reaction to transfusion nor evidence of bleeding after transfusion

Reactions occurring after transfusion tend to reduce the total hemoglobin added by transfusion, so that, at the end of 10 days, the total hemoglobin is but 90 per cent of the amount added by transfusion. This figure at the end of the tenth day is only 50 per cent as great as that of the patients who did not have reactions

These observations uphold the conception that the plasma volume tends to maintain a constant level and that changes in blood volume are brought about by changes in the cell volume only

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CLINICAL SURGERY

FROM ST MARY'S HOSPITAL, LONDON

THE TECHNIQUE OF GASTRODUODENECTOMY

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IN the surgery of simple ulcer of the stomach or duodenum one fact stands out starkly clear. If the ulcer together with a considerable area of the pyloric end of the stomach including the sphincter be removed, the physiological conditions prevailing in the stomach are so altered that a recurrence of the ulceration, while it is not unknown, is extremely unlikely to happen. In the surgical unit at St Mary's Hospital, London, this principle is adhered to whenever possible. The restitution of the alimentary canal is effected by implanting the stomach laterally into the upper part of the jejunum brought up in front of the splenic flexure of the colon which lies very deeply in the abdomen (Fig 1). Axial union of the stomach to the duodenum has been carried out 42 times in the case of duodenal ulcer with 3 deaths (7 per cent) and 28 times in the case of gastric ulcer with 1 death (3.6 per cent). This method of restoration is attractive from a physiological point of view, but the convalescence is not so smooth, being sometimes disturbed by temporary acute dilatation of the stomach, and occasionally there is a little subsequent digestive discomfort which may, perhaps, be related to the loss of mobility of the organ due to the small remaining segment being sutured to the fixed duodenal stump. Hence lateral implantation into the jejunum has become the standard method. In 116 gastroduodenectomies done in this way for duodenal ulcer only 1 death occurred (0.86 per cent). It was due to an injury to the pancreas. In 66 resections for gastric ulcer the mortality has unfortunately been high, 4 deaths (6 per cent). One of these occurred 4 months after the operation from a lung abscess. One was due to peritonitis from a leak at the suture line, one to peritonitis with intact suture line, and another to hemorrhage from a vessel in the cut end of the stomach. The operation has been carried out on weakly, wasted, often anemic individuals and sometimes after 60 years of age.

THE OPERATION FOR DUODENAL ULCER

The abdomen is opened by a right paramedian incision, extending from the neighborhood of the ensiform cartilage to the right of the umbilicus. The rectus muscle is retracted laterally to gain access to the peritoneum.

The duodenum is inspected to determine whether or not excision is possible. Very large ulcers surrounded by massive callous inflammatory tissue which extends so far down the duodenum that the surgeon feels he cannot reach normal intestine for suture are best left alone and treated by gastrojejunostomy. However, if, by careful dissection, the duodenum is freed from adhesions to the gall bladder and other neighboring parts, and particularly if the layer of new-formed tissue over the descending part of the duodenum, so often present, be removed, it will often be found possible to excise ulcers which at

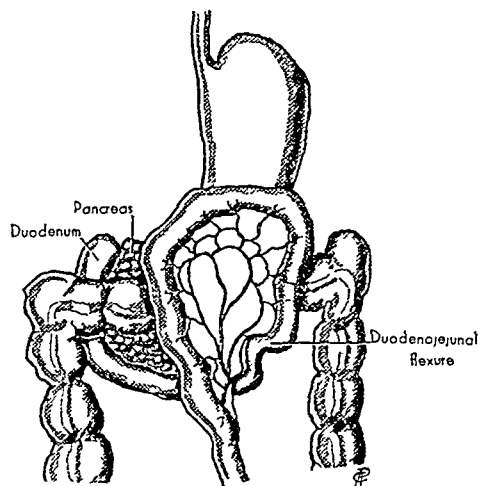


Fig 1 Method of restoring continuity of alimentary canal

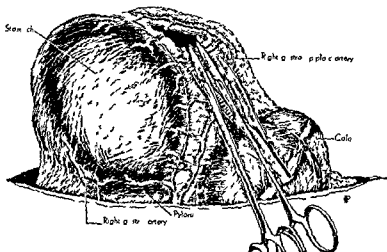


Fig 2 Method of ligating vessels at the greater curvature of the stomach. This and subsequent diagrams are drawn from the viewpoint of the surgeon standing to the right of the patient.

first sight look quite unresectable. Next, at about the middle of the greater curvature of the stomach below the gastroepiploic artery, an aperture is torn in the thin omentum so that the lesser sac is penetrated and the posterior aspect of the duodenum can be examined. There is usually an ulcer here. The extent of invasion of the pancreas is estimated. This preliminary review having shown that resection can be carried out, the vessels of the greater curvature are ligated between the stomach and the gastroepiploic artery. The manner of doing this is shown in Figure 2. Fine No. 00 catgut is used for these ligatures. A length of about 2 inches of the greater curvature is thus bared at about 1½ inches from the pylorus. In a difficult case a similar short length of the lesser curve is ligated off from the gastrophrenic omentum. Two large clamps are then placed across the stomach in this area and the organ cut across between them (Fig 3). This procedure allows of easier access to the posterior

aspect of the duodenum and greatly facilitates the removal. Now, little by little the lower and upper borders of the duodenum are freed to a point distal to the ulcer. Every small vessel must be seen and divided between clamps as it is met. The really difficult part of the operation is on the pancreatic side. Many small vessels come off the pancreaticoduodenal artery which runs in the groove between the pancreas and duodenum. The field must be kept bloodless if possible. Cicatrization may bring the common bile duct in close proximity to the duodenum at its upper border. It is in danger of injury here. In order to avoid damage to the pancreas, which may be fatal or to the common bile duct, the dissection must be kept close to the duodenal wall. Figure 4 represents the dissection completed. If the ulcer has penetrated into the pancreas the base of the ulcer must be left on this viscus untouched. During the dissection the margin of the duodenal wall will be separated from the pancreas and the cavity of the duodenum opened into. It is sometimes rather tedious to find the right layer of separation beyond the ulcer base but it can nearly always be done (Fig 5). A narrow clamp is then placed just beyond the ulcer and the diseased part of the duodenum removed by the cautery (Fig 6). The duodenal stump is closed by two layers of sutures as shown in Figures 7 and 8. Occasionally a reinforcing stitch may be necessary but the omentum is rarely sewed over it. A duodenal fistula has never occurred in this series. On two occasions it seemed almost impossible to arrive at normal duodenal wall beyond the distal

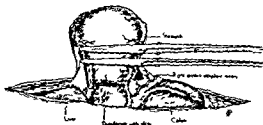


Fig 3 Line of section of stomach in order to facilitate access to a posterior duodenal ulcer.

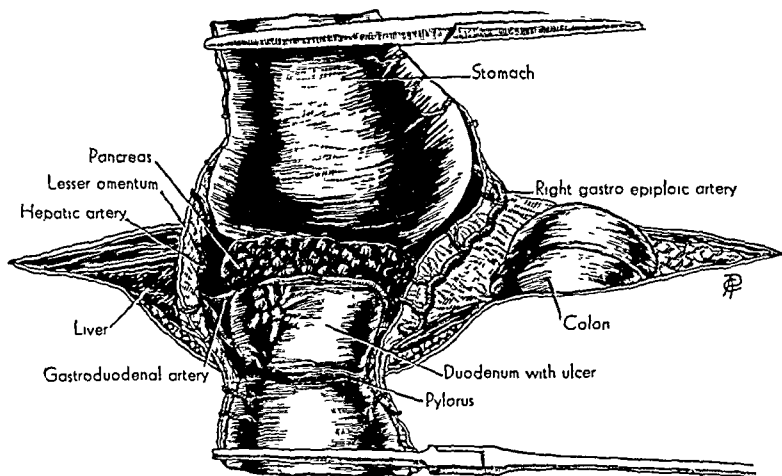


Fig 4 The duodenum has been dissected free beyond the ulcer

edge of an ulcer penetrating the pancreas. In both cases the anterior duodenal wall was folded in and sutured down over the ulcer, the stitches going through the fibrous tissue round the margin of the ulcer. The whole ulcer base was buried in this way and peritoneal surfaces brought into contact with each other. It is dangerous to pass sutures through normal pancreatic tissue, but safe to insert them through the fibrosed destroyed pancreatic tissue immediately surrounding the ulcer. Once, by mistake, in a very extensive ulcer, the common pancreatic and bile duct was cut right across. The cut surface of the gland with the open duct was successfully implanted into the open end of the duodenum.

The surgeon now returns to the proximal part of the stomach and ligates the vessels along the greater and lesser curvatures until he deems a sufficient length has been denuded. It is not possible to estimate accurately the proportion of the stomach removed; the area taken away varies. In length it amounts to 4 or 5 inches approximately and depends upon the amount of dilatation of the stomach which may have taken place. When a sufficient area has been devascularized the first part of the jejunum is drawn up from below the colon and fixed by traction sutures transversely across the posterior aspect of the stomach, the proximal end of the loop being attached to the greater curvature. The two viscera are joined together by a thin catgut, running seromuscular suture. About 4 or 5 inches of jejunum should exist between the duodenojejunal flexure and the greater curvature of the stomach. Two narrow clamps are then placed upon the stomach, from

the upper and lower borders (Fig 9). The clamp on the greater curvature must be placed in position first because the length of its blades corresponds to the length of the slot in the fenestrated clamp, namely $2\frac{3}{8}$ inches. This length is that which has been found to make a suitable communication between the stomach and jejunum. The stomach beyond the clamps is removed by cautery. After a tiny opening is cut in the jejunum one blade of the fenestrated clamp is introduced into its lumen and the junction completed by the cautery technique already described. Figures 9, 10, and 11 show how the stitching is carried out and how the

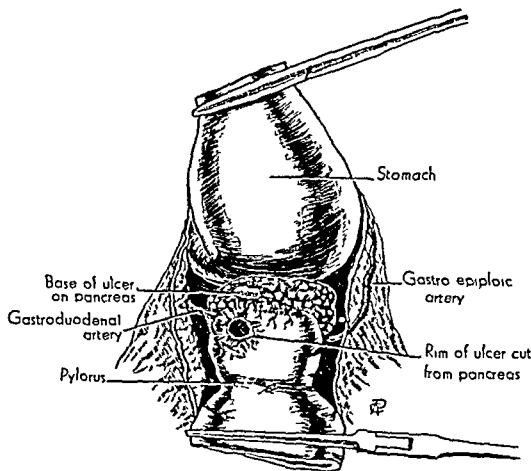


Fig 5 In dissecting free the duodenum the base of a penetrating ulcer has been left on the pancreas

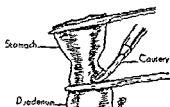


Fig 6-

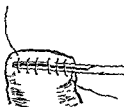


Fig 7



Fig 8

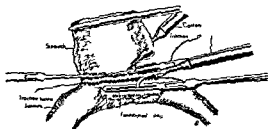


Fig 9

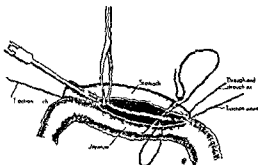


Fig 10



Fig 11



Fig 12

Fig 6 The affected segment of the duodenum is severed by cauterizing

Fig 7 First infolding seromuscular stitch

Fig 8 The closure is completed by invaginating the duodenum still farther the end of the same stitch being used

Fig 9 A sufficient length of stomach has been freed The jejunum has been sutured to the stomach The special clamps have been applied to the stomach and the fenestra

trated clamp to the jejunum The stomach is being cut away with the cauterizing and the opening into the jejunum is being made with the same instrument

Fig 10 The posterior through and through suture

Fig 11 The anterior through and through suture has been inserted and is being carried on to close the redundant opening in the stomach

Fig 12 The through and through suture is being turned by a seromuscular stitch

part of the stomach grasped by the clamp on the lesser curvature is closed The method of inserting the seromuscular suture shown in Figure 12 is important It will be noted that the unopened jejunum is sutured to the stomach distal to the anastomosis If this is not done obstructive kinking might occur at the extremity of the communicating opening for where this is all the circularly running muscle fibers are divided so that a propulsive peristaltic wave cannot take place But in the procedure described any kinking at the lesser curvature is obliterated by the stream of

chyme forced along by the intact jejunum between the anastomotic opening and the lesser curvature of the stomach The abdomen is then closed

THE OPERATION FOR GASTRIC ULCER

The operation is carried out on the same principles As the duodenum is cut across immediately distal to the pyloric sphincter it is not necessary to cut the pyloric part of the stomach across to get access for a difficult dissection The difficulties in gastric resection are due to the ulcer penetrating into the pancreas and the great thick

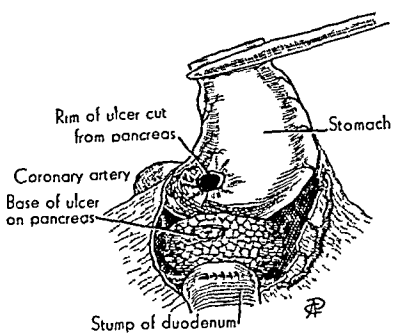


Fig 13

Fig 13 left Diagram to show how a posterior penetrating gastric ulcer is separated from the pancreas leaving its base untouched

Fig 14 Line of section of the stomach in the treatment of ulcers situated high in the viscus

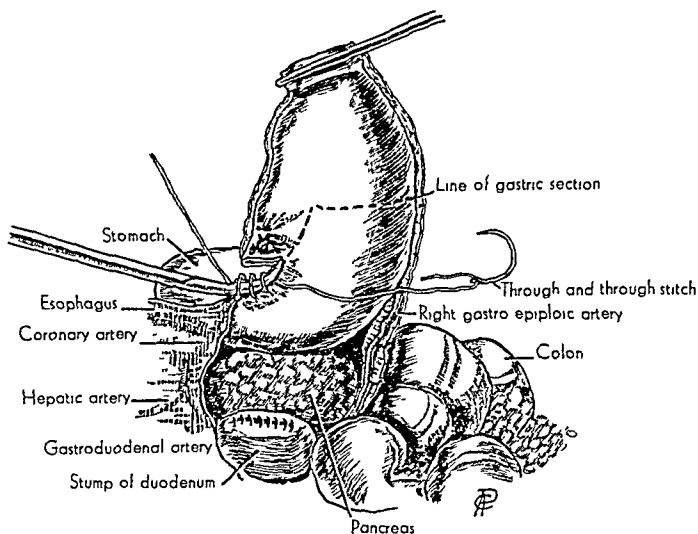


Fig 14

ening of the lesser omentum In order to be able to resect, it must be possible, after opening into the lesser sac as described, to get the finger round the proximal boundary of the ulcer where it is adherent to the pancreas The vessels on the greater curvature are ligated in the usual manner On the lesser curvature great care must be taken The tissue is very hard, often the individual vessels cannot be seen Ligation should be done in small sections and always the thinnest catgut serviceable used because thin ligatures have less tendency to slip

As soon as possible the stomach is turned over to the left When the ulcer penetrates the pancreas its rim must be separated from this organ leaving the base untouched This separation can usually be done avascularly by blunt force (Fig 13) When the stomach has been sufficiently separated the clamps are applied to it proximal to the ulcer and the anastomosis effected as already described Should the ulcer be so high that placing the clamps in this fashion would seem to lead to the sacrifice of an unnecessary amount of stomach, a gutter resection should be done This is carried out as suggested in Figure 14 The clamp shown is a Moynihan cholecystectomy clamp In these high ulcers the curved part of the incision in the stomach near the lesser curvature should be sewed up in two layers before the anastomosis is made with the straight part of the incision Otherwise when the main bulk of the stomach has been cut off the upper part of the incision in the

stomach recedes into the abdominal cavity and becomes very inaccessible

Finally for very high ulcers on the posterior wall of the stomach near the esophagus another procedure may be adopted The ulcer itself is excised with the cautery and the hole in the stomach is carefully sutured The stomach is then anastomosed with the jejunum along a line running distal to the ulcer I have never performed a complete gastrectomy for simple ulcer of the stomach and do not consider it justifiable

During these operations the ordinary precautions against spreading infection, namely the isolation of the operative area by saline soaked packs, is adopted The contents of the stomach and duodenum, as a rule, have very little infective power However, one death already referred to took place from septic peritonitis, though the postmortem examination showed there had been no technical error, and the anastomosis was watertight

After a trial of splanchnic combined with local, and with spinal anesthesia, these methods have been discarded as less satisfactory than general anesthesia with gas and ether Recently a few patients have been operated upon under cyclopropane anesthesia The results have been very promising The patients do not have any solid food until the eighth day Six weeks after leaving the hospital they are allowed to eat any food but warned that, for a year, their meals must be small, though they may be frequent

RADICAL TREATMENT OF INTRACTABLE PRURITUS ANI

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CERTAIN cases of intractable pruritus ani resist all the commonly employed forms of therapeutics. These cases usually have run the gamut of salves, lotions, injections, x-ray treatments, fulguration, and anything that any physician or any layman may have suggested. In desperation patients so afflicted go from one physician to another hoping against hope, that someone may have a remedy for this non-malignant but most incapacitating and nerve-racking disease. At this stage, the perianal skin has undergone such advanced changes as to make it unrecognizable. Grossly and microscopically malignant degeneration seems inevitable. These changes are due to the disease itself, to the constant scratching and irritation and to the various forms of therapy employed, particularly the sclerosing injections and the x-ray treatments. *Radical curative therapy at this time is imperative.*

In the armamentarium of the proctologist, there is no rational therapy for this type of case. The injection of oil-soluble local anesthetics or alcohol does not eradicate the disease except in the event of widespread necrosis. The Ball operation and its various modifications attempt to deprive the part of sensation but fail to eradicate the diseased areas and give but temporary relief.

The operation which we employed and which we will describe was used without knowledge of any like procedure having been performed before. Because of the good results obtained as evidenced in our follow-up it was decided to report these cases. A search of the literature at this time revealed that somewhat similar procedures had been done about 40 years ago.

In 1893 Matthews (2) reported to the Louisville Surgical Society a case of severe pruritus ani treated by removal of the perianal skin. He excised the perianal skin and allowed the wound to heal by granulation. Later in his text book (3) he reported a somewhat different technique. After dissecting the skin free from the subcutaneous tissue he left it attached to the mucous membrane, split it into three sections and tied ligatures at the base of each. These were left to slough off, and the wound was allowed to granulate.

In 1901 Hamilton independently described a somewhat similar operation. He made a circular incision at about the mucocutaneous junction, then an encompassing elliptical incision beyond the diseased area. The entire perianal skin between the two incisions was excised. The remaining skin was mobilized and then brought together anteriorly and posteriorly to the anus by several sutures. The mucous membrane was then sutured to the skin margins.

Montague states that surgeons did not take kindly to these methods because of the prolonged convalescence, severe postoperative pain and the possible interference with sphincteric control. Apparently because of the fear of these distressing features the operation fell into disrepute and little has been heard about this method of treatment since.

When recently we were confronted with 3 cases of severe intractable pruritus ani accompanied by advanced skin changes we decided to attempt a complete excision of all the diseased tissues. The technique of the operation which we devised for this purpose is as follows. The sphincter is gently dilated *not divided*. The entire affected area is circumscribed by a circular incision which usually is at a radial distance of 2 to 3 inches from the anal margin (Fig. 1). The incision is carried down through the entire thickness of the skin until normal subcutaneous fat is encountered. The dissection is then continued in the subcutaneous tissue up to the mucocutaneous junction. In so doing, the fibers of the corrugator cutis ani muscles are severed and the subcutaneous portion of the external sphincter muscle is carefully exposed and protected (Fig. 2). The cone-shaped area of the skin is then split anteriorly and posteriorly (Fig. 3) in order to facilitate the subsequent section at the mucocutaneous junction, which is performed after clamps are placed on the mucous membrane to prevent retraction (Fig. 4). The gluteal skin is mobilized for a distance of 1 to 2 inches. All bleeding points are carefully controlled. Four silk mattress sutures are placed between the mucous membrane and the skin edges at equidistant points anteriorly, posteriorly and laterally. Interrupted silk sutures are used to complete the approximation (Fig. 5). A small piece of vaseline gauze is in



Fig 1 Line of incision

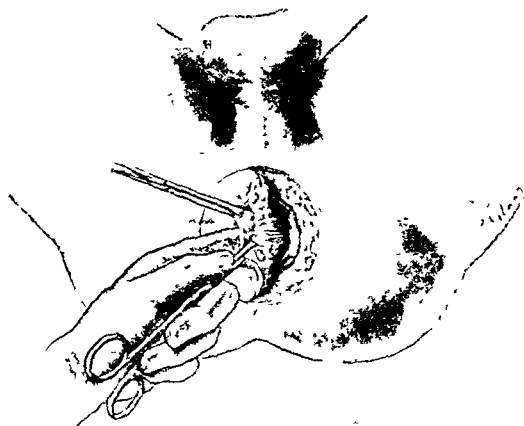


Fig 2 Method of dissection

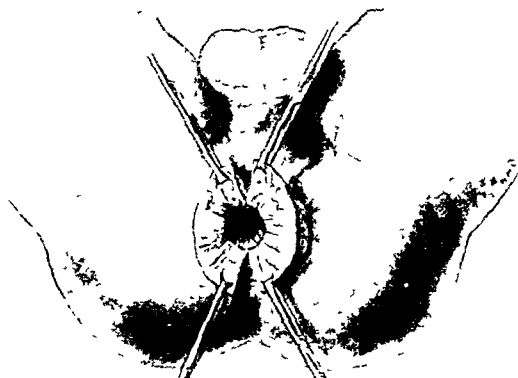


Fig 3 Splitting of the cone-shaped area of skin

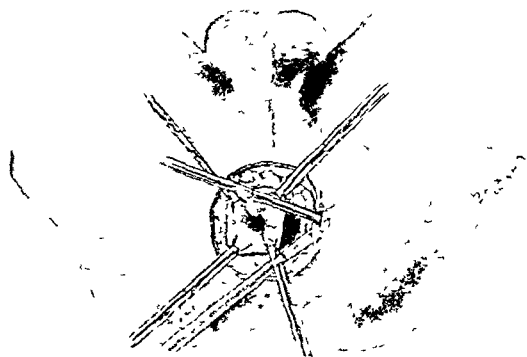


Fig 4 Clamps placed on mucous membrane to prevent retraction

serted into the newly constructed anal canal, and the entire operative area is covered with vaseline gauze

The results were most gratifying. Pruritus disappeared immediately after operation. Surprisingly little pain was present throughout the convalescence. The average period of hospitalization was only 11 days. The sutures, which were employed largely to prevent undue upward retraction of the mucous membrane and outward retraction of the skin, usually cut through between the fifth and eighth day, and moderate separation of the skin and mucous membrane occurred. This allowed the mucosa to retract to a level approximating the previous mucocutaneous junction. The intervening space filled in with granulation tissue and subsequently epithelialized. Complete healing occurred in from 6 to 10 weeks.



Fig 5 Interrupted silk sutures complete approximation

after operation Stricture was not encountered In 1 case there was a slight narrowing which promptly responded to two digital dilations Temporary incontinence was observed in 2 of the 3 cases This lasted less than 2 weeks and good sphincteric tone gradually returned, as could be demonstrated by marked contraction of the sphincter upon irritation of the new perianal skin

In addition to the fact that the patients were overjoyed with the complete cure effected by this procedure, their general condition improved remarkably

CASE REPORTS

CASE I H F (Hospital No 301427) a 63 year old man was admitted to the rectal clinic December 1933, complaining of intense itching in and about the anus for the past 15 years During this period he had at first tried many conservative methods of treatment but finally in May 1932 he was admitted to another hospital where an anal operation was performed Communication with this hospital revealed that the operation consisted of excision of redundant anal tissue Relief from the pruritus was very short lived and after again attempting various forms of non-operative therapy he was re-admitted to the same hospital in May 1935 This time a hemorrhoidectomy was performed The symptoms became so severe shortly after this that the patient could not sleep was in constant pain and began to lose weight very rapidly

Physical examination disclosed an elderly male in apparent discomfort General examination was essentially negative There was no evidence of fungus infection of the feet

Proctologic inspection disclosed a cauliflower like growth surrounding the entire anus and extending outward for a distance of 2 inches from the anal margin The skin was hypertrophic gray white in color and markedly thickened and indurated Numerous ulcerations were present as well as polyp like nodules Beyond this area the skin was reddened thickened and excoriated Palpation revealed marked anal spasm but otherwise the region was negative Anoscopy showed the anal canal to be normal in appearance Small internal hemorrhoids were noted but no hypertrophied papillae or enlarged crypts Sigmoidoscopy with the instrument passed full length revealed the mucosa normal in appearance throughout

The stool was brown in color and of normal consistency reaction acid and no blood ova or parasites were found

The blood Wassermann was negative the blood sugar was 100 milligrams per 100 cubic centimeters the blood urea was 10 milligrams per 100 cubic centimeters Hemoglobin was 82 per cent white blood cells 6800 of which 62 per cent were polymorphs 29 per cent lymphocytes 3 per cent monocytes and 3 per cent eosinophiles The urine was negative

Biopsy of the perianal skin was performed The pathological report was fibro-epithelial polyp with conspicuous acanthosis and inflammation Please wait patient The patient was then referred to the radiotherapy department for consultation The opinion rendered was Radiation is not indicated in a condition of this kind Advise wide surgical removal because this is undoubtedly a precancerous condition

In March 1936 the patient was admitted to the surgical service for radical operation which was performed as described above by Dr Ralph Colp

Pathologic report—macroscopic examination Specimen consists of a resected anus and perianal tissue The skin and subcutaneous tissue about the anus is roughly oval in shape and measures approximately 8 5 by 6 centimeters The perianal skin appears thickened coarse with several irregular folds which are quite firm Here and there are small irregular ulcerations approximately 3 by 2 millimeters in diameter Partially encircling the anus a short distance from it is a shallow ulcerated area the base of which is covered by granulation tissue It measures 3 centimeters by 1 5 centimeter No unusual features are noted in the subcutaneous tissue

Microscopic examination was reported Acanthosis and chronic non specific inflammation with ulceration No evidence of tumor

The postoperative course was uneventful About the sixth day the sutures cut through and were removed Treatment then consisted of frequent hot baths and wet dressings The patient was discharged on the ninth day and further dressings were done at the clinic The wound healed by granulation and was completely epithelialized in 5 weeks For the first 2 weeks there was some incontinence of liquid feces but as healing progressed he regained complete control He was last seen on January 5 1938 at which time he reported that he had been completely free from pruritus since operation 22 months before The new perianal skin appeared soft and normal in texture Control was perfect and there was no stricture There was however a slight eversion of mucosa on one side Digital examination revealed good sphincteric tone The general physical examination however was even more satisfactory His entire appearance was altered He had been transformed from a harassed gaunt chronically sick old man into a cheerful pleasant personality

The indications for radical surgical therapy in this case were very definite 15 years of severe itching and pain a skin lesion that was becoming progressively worse showing no tendency at any time to regress, a pathological report that implied danger of malignancy and a clinical appearance that caused both the surgeon and the radiotherapist to feel certain of its malignant potentialities

CASE 2 H I (Hospital No 30906) a 29 year old German chef was admitted to the rectal clinic on September 18 1936 complaining of itching pain and lumps about the anus His illness had started 10 months prior to admission with the appearance of several small warty growths in the perianal region These had increased rapidly in size and number and were associated with severe pain and intense itching He had been treated in two clinics where fulguration and partial excision had been performed but the relief had been of very short duration After a few weeks the growths recurred and grew rapidly again He then received several x ray treatments with but slight improvement The patient had noticed that after the temporary improvement which followed the fulguration excision and x ray treatments the growths tended to recur with greater rapidity and the symptoms of pain and itching became more intense His symptoms became so severe that he was unable to sleep he could not continue his occupation his appetite failed and he lost 20 pounds in weight Several weeks before admission he observed the appearance of a number of growths on the shaft and glans of the penis

Inquiry into his past history disclosed a traumatic

hemothorax 12 years ago and pneumonia 7 years ago. Shortly after he recovered from the pneumonia, he became infected with gonorrhea and syphilis. The gonorrheal infection cleared up rapidly, the luetic infection had been treated with bismuth and intravenous arsenicals. The exact number of injections was not known. The last treatment had been given 1 year ago. Blood and spinal fluid Wassermann tests done during the past year were negative.

General physical examination was negative except for the local condition.

Proctological examination The entire perianal area for a distance of 2 to 3 inches from the mucocutaneous junction was covered with numerous large and small condylomas. A few of these appeared roughened and hornified. The skin was quite red, markedly thickened, indurated, and tender. There were innumerable scratch marks.

Digital examination In the anal canal were felt a number of small hard warty growths similar to those seen on the perianal skin.

Anoscopy revealed the rectal mucosa to be normal in appearance, there was no evidence of proctitis or infected crypts. In the anal canal, distal to the mucocutaneous junction, were seen several condylomas, similar in appearance but smaller in size than those on the perianal skin.

Sigmoidoscopy with the instrument passed full length showed no abnormality.

Examination of the genitalia revealed several small condylomas on the glans and shaft of the penis.

The blood Wassermann was negative. Rectal smears for gonorrhea were negative. The Frei test was negative. The urine was negative. One of the condylomas was removed and pathological sections were made. The report verified the clinical diagnosis of condyloma.

The patient was desperate and begged for any method of treatment, however radical, which would give immediate and lasting relief. It was felt that conservative methods had been unsuccessful and that radical surgery was indicated. Accordingly, the patient was admitted to the surgical service and was operated upon on September 30, 1936 by Dr. Amiel Glass.

After operation, the patient did very well. Most of the sutures cut through on the sixth and seventh days and separation occurred between the skin and the mucous membrane. This area rapidly became filled with healthy granulation tissue. He was discharged on the fifteenth day after operation. Curiously enough, at the time he left the hospital, it was noticed that the condylomas of the penis had completely disappeared, although they had received no local treatment.

Six weeks after operation, the wound was completely healed, and the patient felt well. Bowel movements were normal and sphincter control was perfect.

The patient was last seen in January, 1937, at which time the anus appeared normal except for slight narrowing of the anal orifice. This required only two digital dilatations. Shortly after this, the patient moved to another city because employment was available there. He was last heard from about one year after operation when he communicated with his family physician and informed him that he was entirely symptom free and normal in every respect.

The indications for radical surgical therapy in this case were very definite: continuous intense pruritus and severe pain for 10 months, quick recurrence of the lesions after surgical removal and electrodesiccation, and failure to obtain any relief by x-ray or any other form of treatment.

CASE 3 L.R. (Hospital No. 414601), a 45 year old physician, was first seen by one of us (S.D.M.) in May, 1937. His history dated back to 1925 at which time he had a few small perianal warts treated by fulguration. As a result of this procedure he sustained burns of the perianal

skin which healed very slowly. Pruritus first set in at this time. The itching became progressively worse and was associated with painful fissures. Many forms of local palliative therapy were employed without relief. In 1928, after suffering intensely for 3 years, he was seen by a dermatologist who instituted x-ray therapy. The patient secured moderate relief for about 2 months, but then relapsed and the pruritus and pain became worse than ever. During the next several years he was treated by many physicians and many types of treatment were used. In 1932, he had a series of injections of oil soluble anesthetics. Multiple abscesses developed following this, and new ones continued to appear during the next 6 months. X-ray treatments were again given, but this time failed to afford even temporary relief. The patient could not sleep without the use of large doses of sedatives and even then spent many sleepless nights. He was constantly in misery, his general health was rapidly failing, and he could not attend to his work. His mental state was such that he was prepared to undergo any procedure rather than continue life as it was.

General physical examination was essentially negative.

Proctologic examination The perianal skin for a distance of 2 inches from the anal margins appeared markedly thickened and hypertrophic, and was thrown into edematous folds. Between these folds were deep ragged infected fissures. The skin immediately adjacent to the anal margins appeared "parboiled" and felt quite hard, whereas the more distant skin appeared erythematous and felt indurated.

Digital examination The ampulla of the rectum and the upper end of the anal canal were normal. The distal portion of the anal canal was tender and indurated.

Anoscopy revealed a few small internal hemorrhoids. No crypts or hypertrophied papillae were found. The pectinate line was completely obliterated by the pathological process which extended up to it.

Sigmoidoscopy with instrument passed full length revealed no abnormalities. Skin scrapings were negative for fungi. Urinalysis was negative.

During the ensuing 4 months the patient was treated with bland ointments of many varieties and with an autogenous vaccine made from one of the many perianal abscesses which he developed during this period. The condition became progressively worse, both subjectively and objectively, and in September, 1937, he agreed, in desperation, to submit to radical surgery. He was admitted to the Private Pavilion of the Mt. Sinai Hospital, and operated upon on September 27, 1937, by one of us (S.D.M.). The procedure described was employed.

Pathologic report "Specimen consists of two portions of skin of similar size measuring 8 by 4.5 centimeters in the greatest diameter. The epithelial surface is somewhat puckered in areas and also shows an irregular yellowish pink firm thickening. The subcutaneous tissue is slightly hemorrhagic."

Microscopic examination report was "Hyperkeratosis with chronic inflammation."

The postoperative course was remarkably smooth. There was practically no pain until the fifth day when the sutures cut through. Upon removal of the sutures, this slight discomfort disappeared. Healthy granulations appeared where the skin and mucous membrane had separated. The patient was discharged on the eighth postoperative day and started to resume practice on the tenth day. During the first 2 weeks after operation, sphincteric control was not perfect, but as healing progressed, normal sphincter function returned. The wound was completely healed 5 weeks after operation. The new skin appeared normal, sphincter tone was good, there was no narrowing of the anal orifice, and the patient was completely free from pruritus and pain.

after operation Stricture was not encountered In 1 case there was a slight narrowing which promptly responded to two digital dilations Temporary incontinence was observed in 2 of the 3 cases This lasted less than 2 weeks and good sphincteric tone gradually returned as could be demonstrated by marked contraction of the sphincter upon irritation of the new perianal skin

In addition to the fact that the patients were overjoyed with the complete cure effected by this procedure, their general condition improved remarkably

CASE REPORTS

CASE 1 H F (Hospital No 391427) a 63 year old man, was admitted to the rectal clinic December 1935 complaining of intense itching in and about the anus for the past 15 years During this period he had at first tried many conservative methods of treatment but finally in May 1937 he was admitted to another hospital where an anal operation was performed Communication with this hospital revealed that the operation consisted of excision of redundant anal tissue Relief from the pruritus was very short lived and after again attempting various forms of non-operative therapy he was re-admitted to the same hospital in May 1935 This time a hemorrhoidectomy was performed The symptoms became so severe shortly after this that the patient could not sleep was in constant pain and began to lose weight very rapidly

Physical examination disclosed an elderly male in apparent discomfort General examination was essentially negative There was no evidence of fungus infection of the feet

Proctologic inspection disclosed a cauliflower like growth surrounding the entire anus and extending outward for a distance of 3 inches from the anal margin The skin was hypertrophic gray white in color and markedly thickened and indurated Numerous ulcerations were present as well as polyp like nodules Beyond this area the skin was reddened thickened and excoriated Palpation revealed marked anal spasm but otherwise the region was negative Anoscopy showed the anal canal to be normal in appearance Small internal hemorrhoids were noted but no hypertrophied papillae or enlarged crypts Sigmoidoscopy with the instrument passed full length revealed the mucosa normal in appearance throughout

The stool was brown in color and of normal consistency reaction acid and no blood ova or parasites were found

The blood Wassermann was negative the blood sugar was 100 milligrams per 100 cubic centimeters the blood urea was 10 milligrams per 100 cubic centimeters Hemoglobin was 82 per cent white blood cells 6800 of which 65 per cent were polymorphs 20 per cent lymphocytes 3 per cent monocytes and 3 per cent eosinophiles The urine was negative

Biopsy of the perianal skin was performed The pathological report was fibro-epithelial polyp with conspicuous acanthosis and inflammation Please see next patient The patient was then referred to the radiotherapy department for consultation The opinion rendered was Radiation is not indicated in a condition of this kind Advise wide surgical removal because this is undoubtedly a precancerous condition

In March 1936 the patient was admitted to the surgical service for radical operation which was performed as described above by Dr Ralph Colp

Pathologic report—macroscopic examination Specimen consists of a resected anus and perianal tissue The skin and subcutaneous tissue about the anus is roughly oval in shape and measures approximately 8 5 by 6 centimeters The perianal skin appears thickened coarse with several irregular folds which are quite firm Here and there are small irregular ulcerations approximately 3 by 3 millimeters in diameter Partially encircling the anus a short distance from it is a shallow ulcerated area the base of which is covered by granulation tissue It measures 3 centimeters by 1/2 centimeter 20 unusual features are noted in the subcutaneous tissue

Microscopic examination was reported Acanthosis and chronic non specific inflammation with ulceration No evidence of tumor

The postoperative course was uneventful About the sixth day the sutures cut through and were removed Treatment then consisted of frequent hot baths and wet dressings The patient was discharged on the ninth day and further dressings were done at the clinic The wound healed by granulation and was completely epithelialized in 5 weeks For the first 2 weeks there was some incontinence of liquid feces but as healing progressed he regained complete control He was last seen on January 3 1938 at which time he reported that he had been completely free from pruritus since operation 22 months before The new perianal skin appeared soft and normal in texture Control was perfect and there was no stricture There was however a slight eversion of mucosa on one side Digital examination revealed good sphincteric tone The general physical examination however was even more satisfactory His entire appearance was altered He had been transformed from a harassed gaunt chronically sick old man into a cheerful pleasant personality

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CASE 2 H I (Hospital No 390926) a 38 year old German chef was admitted to the rectal clinic on September 18 1936 complaining of itching pain and lumps about the anus His illness had started 6 months prior to admission with the appearance of several small warty growths in the perianal region These had increased rapidly in size and number and were associated with severe pain and intense itching He had been treated in two clinics where fulguration and partial excision had been performed but the relief had been of very short duration After a few weeks the growths recurred and grew rapidly again He then received several x ray treatments with but slight improvement The patient had noticed that after the temporary improvement which followed the fulguration excision and x ray treatments the growths tended to recur with greater rapidity and the symptoms of pain and itching became more intense His symptoms became so severe that he was unable to sleep he could not continue his occupation his appetite failed and he lost 30 pounds in weight Several weeks before admission he observed the appearance of a number of growths on the shaft of his penis

Inquiry into his past history disclosed a traumatic

CARCINOMA OF THE MAJOR VESTIBULAR (BARTHOLIN) GLAND

S MILTON RABSON, M D , and L H MEEKER, M D , New York, New York

MALIGNANT disease of Bartholin's or the major vestibular gland, is rare and not often considered in the differential diagnosis of diseases of that organ. Usually the diagnosis is made only at operation when the pre-operative diagnosis of cyst or abscess is upset by the finding of a solid neoplasm. Here, as elsewhere in the body, careful observation of the patient and timely surgical intervention, together with the laboratory examination of the excised material, offer the only hope of recovery.

EMBRYOLOGY AND NORMAL ANATOMY OF BARTHOLIN'S GLAND

Huguier was the first to describe extensively the gross anatomy of the major vestibular gland. The microscopic picture, begun by Langerhans, was not elaborated until the present century when Jambon and Chaboux, as well as Cullen in this country, carefully studied series of specimens from various age groups. Schroeder's résumé of the embryology and anatomy is the most concise yet published, and completes the material upon which this study is based.

The major vestibular gland is the homologue of the bulbo-urethral gland of Cowper in the male but develops later. Schaffer, in his textbook, refers the reader to the description of Cowper's gland in discussing Bartholin's gland. The unequal development of the glands, beginning about the third fetal month, as soon as there is external sex differentiation, starts in the vestibular epithelium of the urogenital sinus. The latter is very definitely developed in the embryo at the end of the fourth month. Differentiation is virtually complete by birth. At birth, tubules of a single layer of pale cuboidal cells, staining with mucicarmine, lie in an interstitium, at the periphery of which are other tubules of darker smaller mucicarmine-negative cells.

Smaller ducts are formed of multilayered epithelium, cuboidal for the most part, and cylindrical directly on the lumen. The excretory duct has, according to Schroeder, a multilayered epithelium similar to transitional epithelium with squa-

mous cells basally and columnar superficially. The gland diminishes in size between 9 and 12 years and then definitely increases at puberty, to decrease and atrophy in senility.

The bilateral gland lies on the urogenital diaphragm surrounded by the vascular vestibular bulb, and is separated from the vagina by perineal soft tissues and the vaginal sphincter bundles. The gross measurements are given as 11 to 15 millimeters in length and 0.5-3.0 millimeters in width. In more than three-quarters of a series of cases the chief excretory ducts lie within 1 to 2 millimeters of the border of the labium minor, with a lumen of 1 millimeter and a length of 1 centimeter (Schroeder). This duct opens into the vestibule just below the outer border of the hymen.

Cullen compared the gland to an unevenly developed bunch of grapes, with the main duct compared to the stem, the secondary and terminal ducts or excretory canals to the branches, and the lobules to the fruit. In the adult, the pale columnar cells of the gland alveoli have small deep-staining nuclei and pale cytoplasm staining variably with mucicarmine. These cells rest on a membrana propria of the surrounding connective tissue which is highly vascular with much elastica and less smooth muscle. The gland terminal ducts or excretory canals, lined by one to several layers of cuboidal to columnar cells, unite in an ampulla lined by columnar epithelium, and here the true excretory or main duct begins. As it enlarges, the main duct is lined by flattened transitional or squamous epithelium and by vestibular squamous epithelium in its outer portion. The gland has been characterized by some as acinar and by others as tubular.

Outside the capsule are large calibered nutrient arteries and veins, nerves, and striated muscle bundles. The striated muscle within the capsule, however, is sparse and is found only about the large excretory canals or ducts. The blood supply, by large arterioles, is from the internal pudendal and bulbar arteries and is distributed by numerous capillaries between the acini, which end peripherally in venules emptying into the bulbar and pudendal sinuses accompanied by nerves and lymphatics. The secretion of mucus is intermittent because of neurogenic alteration.

From the Department of Pathology and Bacteriology, New York Post Graduate Medical School and Hospital, Columbia University.

He was last seen 4 months after operation. He had gained 20 pounds, was working harder than ever, and had been sleeping well without the use of sedatives. There were no rectal complaints.

The indications for radical surgical therapy in this case were also very definite. A 12 year history of intractable pruritus and pain, an intolerable existence, failure to obtain relief for even short periods with any form of therapy, and a clinical appearance that gave the impression of possible malignant degeneration.

SUMMARY

1. Three cases of long standing severe pruritus and with extreme skin changes have been presented.

All 3 patients had been treated by the usual accepted methods with no lasting relief.

2. A radical operation which has been utilized in an attempt to cure these patients permanently has been described.

3. Results have been uniformly satisfactory, all three patients having been completely relieved

of their pruritus for the first time since its onset. They have been followed and have remained well for periods varying from 4 to 22 months after operation.

4. Contrary to general belief, this type of operation is not followed by long convalescence, severe postoperative pain, stricture or sphincteric incontinence.

5. This method is not advocated for the treatment of the usual case of pruritus, but is indicated only for cases of long standing intractable pruritus and particularly those with pronounced and possibly premalignant skin change.

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lished a total of 56 such cases, not including the two described in this paper.

Type of carcinoma In 7 instances no information is given as to the type of carcinoma. Two cases are described only as "anaplastic," and one each as solid, small cell and adenosquamous cell carcinoma. Adenocarcinomas numbered 29, and squamous cell carcinomas, 12.

Age The youngest patient is that of Beckmann, 19 years. Four cases are reported of patients between 26 and 30 years of age. Seven cases are recorded in the fourth decade, 16 in the fifth, 12 in the sixth, 5 in the seventh, and 3 in the eighth decade of life, the decades before and after the menopause are the periods of life most affected.

Symptoms The most frequent symptom is the appearance of a mass in either side of the vulva, as described in 35 cases, and present for an average of 15 months before medical aid was sought. Whether a benign condition was at first present cannot be answered. Pain was a much less prominent symptom. Dyspareunia and discomfort on walking and sitting were noted. In 13 of 37 cases the inguinal nodes were involved when the patients were first examined, although Kehrer and Tobler both state that the regional lymph nodes are involved relatively late in the disease. Femoral and iliac node involvement has also been recorded. Metastases have been found in vertebræ (Fabricius), pelvis and chest (Lyle).

Therapy In most instances resection was performed, although in several cases incision was made before the neoplastic character of the condition was determined. Radiation therapy, both x-ray and radium, was also used, usually after operation as in Hunt and Powell's third case which was well after 2 recurrences, and in Healy's first case, each 11 years after the original operation. Without radiotherapy the longest period of life after operation (the patient still alive at the time of publication) was 3½ years (Eden, Polakillon). Fabricius' patient died 5 years after resection. Recurrence took place after a few months in most cases and a second recurrence was frequent. Most authors do not record the date of death or necropsy findings.

CASE HISTORIES

CASE 1. R. A. R. (a patient of Dr. Eugene L. Jewett), 32 years old, white, was admitted to the New York Post-Graduate Hospital August 28, 1934, for x-ray therapy. In 1926, she is said to have been treated for pulmonary tuberculosis. About 3 months before admission she noticed a small mass in the left half of the vulva which caused little or no pain. The mass grew larger and became distinctly painful. Physicians consulted made a diagnosis of an infected Bartholin's gland but did not advise operation. Because of the rapid increase in size and the patient's

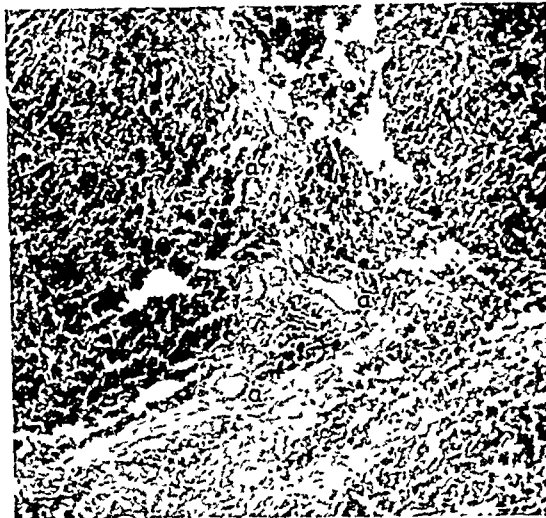


Fig. 2. Photomicrograph of anaplastic adenocarcinoma of the major vestibular (Bartholin) gland (Case 1). a, Normal ducts lined by cuboidal to columnar epithelium. Low power.

insistence, the mass was removed and submitted for examination.

At admission to hospital there were no signs of acute or chronic disease except for slight discrepancy in size of pupils. The wound in the labium majus was partly healed. The left inguinal nodes were enlarged, firm, and movable. The local site, the vulva, both groins and the lower abdomen were radiated separately. The patient was discharged improved, August 30, 1934.

She was readmitted 3½ months later for 3 days. Amenorrhea followed the x-ray therapy of August. In November, 1934, small nodes were excised from the left groin but not submitted for examination. Because of the recurrence in the groin where, beneath the recent surgical scar, several soft matted glands were palpated, excision and further x-ray radiation were advised. The complement fixation test on spinal fluid for syphilis was positive, with a colloidal gold reaction of 1233310000.

At operation, December 14, 1937, two deep inguinal nodes, matted together and apparently well encapsulated, were removed. There were no signs of recurrence at the site of the primary neoplasm of Bartholin's gland. Following discharge from the hospital, x-ray radiation was applied to the abdomen and perineum, to the neck and chest (February and March, 1935) and once to the groin (May, 1935). Antilutetic treatment was given at the same time.

In May, 1935, the patient, who had been suffering from dizziness, weakness, nausea, and vomiting, was knocked down by a taxicab. She was unconscious for about 10 minutes and was removed to another hospital where she remained until transferred to the New York Post-Graduate Hospital the following month. Following the accident all symptoms became aggravated and headache, previously unnoted, now appeared. There were also periods of apparent confusion and failure to respond normally to questions.

At admission the mental status was good although the patient complained of marked deafness. She was emaciated and anemic. The pupils were irregular and did not respond to light. A large, hard, circumscribed mass, pal-



Fig 1 Photomicrograph of structures from inflamed major vestibular (Bartholin) gland *a* normal acini communicating with the duct *b* completely obliterated by hyperplastic transitional epithelium (compare with Fig 3 for similarity of cell type) Low power

DIAGNOSTIC CRITERIA OF PRIMARY CARCINOMA OF BARTHOLIN'S GLAND

It is not always possible to determine whether Bartholin's gland is the primary site of the malignant vulval neoplasm. The cases reported by Katkowski and by Taussig are probably secondary in the gland while Savourin's case is not one of carcinoma. Melanoma doubtless was the correct diagnosis in the case published by Sinn. These cases are not included in our summary.

Honan enumerated four criteria which must be satisfied before an indisputable diagnosis of primary carcinoma of Bartholin's gland is made. These are (1) typical vulval site (2) position deep in the labium (3) connection with the gland duct and (4) the presence of intact gland tissue. These conditions are satisfied in our first case. The typical site in the lower third of the labium majus and deep within it was noted in the second case. No normal portions of the gland or duct were found in the microscopic sections available and the gross specimen had long since been discarded (1926).

If, in addition to the requirements already mentioned the skin is intact and the carcinoma a frank adenocarcinoma as suggested by Schaeffer the major vestibular gland is unquestionably the primary site. Numerous authors point out that the smaller ducts communicating with the acini (Fig 1, *a*) are lined by transitional epithelium (Fig 1, *b*) a fact confirmed by us in sections of routine surgi-

cal material. This type of epithelium is not present in vulval structures other than Bartholin's gland. A study of many sections of the second case and a comparison with the normal disclose a striking similarity to the cell types of the normal transitional epithelium and justify classing it among the carcinomas of the major vestibular gland.

The problem of the primary site is not as readily clarified in cases of squamous cell carcinoma. If normal glandular structures lined by columnar epithelium are seen contiguous to, or continuous with, the squamous cell carcinoma, it has been assumed that the latter arose from metaplastic epithelium. Frank and Kehrer speak of such a possibility, although such metaplasia has not been encountered in routine surgical material examined by us. A more likely point of origin is the stratified squamous epithelium which normally extends inward from the skin and lines the ducts for a variable distance. That distance may vary with the extent of destruction of the original transitional epithelium and its replacement by the squamous epithelium. Unless the squamous cell carcinoma is seen to begin in the skin over the major vestibular glands, squamous cell carcinoma of this area involving such glandular structures must be included among the carcinomas of Bartholin's gland.

ANALYSIS OF LITERATURE

Frequency. Bartholin's gland carcinoma is relatively rare. Burgeile could report only 3 primary vulval carcinomas among 20,000 patients under his care, one of which was of the major vestibular gland. At the Mayo Clinic according to Hunt and Powell there were 170 operations on the major vestibular gland over a period of 15 years. Of these 150 operations were 10 cysts, 17 for infections and 2 for carcinoma. Over a later 10 year period Mayo and Barber reported 281 cysts of which 154 were operated upon. Three of these were carcinomas. Lynch wrote that this tumor is undoubtedly rare, yet the literature does not properly express the frequency, since vulval growths are usually seen by men in general practice who do not report them and who may be content merely with their removal.

At the New York Post Graduate Hospital during the past two decades there are recorded among the lesions of Bartholin's gland 14 infections, 10 abscesses, 92 cysts and the 2 carcinomas here reported a frequency of 1.1 per cent. These figures are generally similar to those of the Mayo Clinic where the carcinomas of Bartholin's gland comprised 0.8 to 0.9 per cent of all diseases of that organ. There have now been recorded or pub-

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Fig. 3 Photomicrograph of transitional cell carcinoma of the major vestibular (Bartholin) gland (Case 2) Low power (Compare with Figure 1 for similarity of cell type)

pated in the epigastrium extended into the right upper quadrant. There were scars on the anterior abdominal wall possibly the result of the radiation and the pubic hair was absent. In the left inguinal region in addition to the operation scars there were a few small enlarged nodes. There was no sign of recurrence at the primary site and a purulent vaginal discharge was present.

Obituary examination attributed the deafness to the venereal condition aggravated by the trauma of injury. Vomiting continued and the abdominal mass increased in size. Incontinence of urine and feces appeared accompanied by mental stupor and drowsiness. The temperature slowly rose to 102 to 103 degrees at the time of death.

At necropsy 13 hours later there was no evidence of recurrence of the neoplasm at the original site of the left labium majus. Metastases were found in the brain, lungs, heart, liver, pancreas, a femoral kidney, left ovary and mediastinal lymph nodes. These were more or less sharply delimited from the surrounding tissues and were formed of moderately soft gray to grayish white areas with central zones of necrosis and hemorrhage.

The dural metastases were situated on the left posterior portion of the falx cerebri excavating the adjacent areas of the left occipital lobe. A marked dilatation of the lateral ventricles and particularly of the third ventricle was caused by a 3 centimeter metastasis resting on the anterior portion of the fourth ventricle floor and slightly adherent to the culmen. The cardiac metastasis was in the endocardial tissues.

Description of specimen. The primary neoplasm removed from the left labium majus 30 by 22 by 20 millimeters was covered by a thin connective tissue capsule. On section firm gray tissue intermingled with yellow tissue was indefinitely lobulated. Microscopically there was a diffuse proliferation of deep staining closely packed small cells arranged in minute clusters or thin strands separated by a small amount of vascular connective tissue (Fig. 2). The neoplastic cells were generally polyhedral with scanty cytoplasm and dense pyknotic nuclei. Some cells were fusiform and where the gland structures were well formed they were cuboidal. Mitotic division figures were not numerous. In

the neoplasm there were cross sections of small gland duct lined by normal cuboidal to columnar (Fig. 2a) epithelium while others were filled with exfoliated epithelium similar to that of the main tumor mass. In scattered glandular structures both neoplastic and normal cuboidal epithelium lined the acini. The diagnosis was anaplastic adenocarcinoma.

The histological picture seen in the inguinal node first removed and in the metastases at necropsy was generally similar to that of the primary labial growth. In the pus the neoplastic cells formed large distended blood sinuses.

CASE 2. A. J. G. 53 years old (a patient of Dr. John H. Morris) white single was in the New York Post-Graduate Hospital for a fortnight in May 1926. She complained of a large swelling in the vagina. About 4 months before she had noted a swelling in the left side of the vulva which gradually increased in size. During the few weeks before admission there was marked pain as well as difficulty in sitting and on defecation. A provisional diagnosis of Bartholin's cyst was made on finding a tense non-tender large swelling between vagina and rectum. At operation resection a solid tumor was found. There were rapidly growing pelvic metastases and the patient died less than 6 months later.

The specimen submitted for examination consisted of 150 cubic centimeters of broken-down tissue including moderately soft tissue and large blood clots. Microscopically there was a connective tissue stroma arranged for the most part as slender papillae on which were grouped thick layers of epithelial cells irregular in shape with numerous mitotic figures. The cells resembled those of transitional epithelium (Fig. 3). The diagnosis was papillary carcinoma apparently derived from transitional epithelium.

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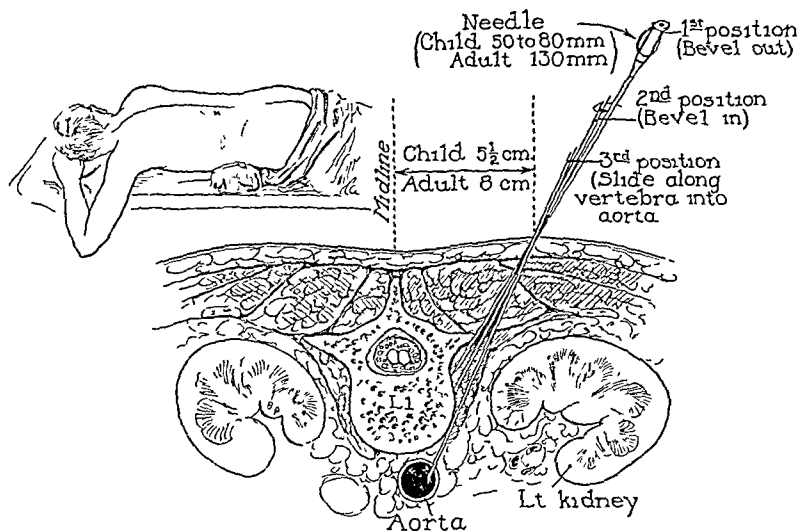


Fig 1 The position of the patient and the various steps in puncture of the abdominal aorta

ease and in both instances the puncture in the aorta was found and there was no evidence of undue trauma or evidence of leakage about the site of injection. As there are more highly developed muscular coats in the wall of the aorta than there are in the vena cava, it is safer from the standpoint of leakage to use the aorta as a site of injection rather than the vena cava. Furthermore, the vena cava is slightly more inaccessible than the aorta as it would have to be approached from the right side of the vertebral column and in many instances it lies practically in front of the body of the vertebra, whereas the aorta is usually placed more toward the left lateral margin of the body of the vertebra.

This is a new technique for the transfusion of blood into the abdominal aorta. The method has been used to transfuse blood into 6 infants and the results have been satisfactory. In one case, in which the patient was an adult, the method of treatment was used for arteriography with contrast media.

The technique is somewhat more simple if the patients are children than it is if they are adults, inasmuch as the muscular and skeletal development of children is not so marked. The method is not to be advocated in the hands of persons who do only an occasional transfusion, but is offered as an adjunct for those who are doing transfusions regularly.

A TECHNIQUE FOR TRANSFUSION OF BLOOD INTO THE ABDOMINAL AORTA

EDWARD B TUOHY, M D M S (Anes), Rochester Minnesota

THE administration of blood to infants and young children frequently presents difficulties. Usually the superficial veins of the arms, hands and feet are small and will not permit the use of a very large caliber needle for venipuncture. Whereas the anterior fontanel of infants may be used as the site of injection it does present certain hazards, namely, the danger of extradural leakage of blood and the possibility of infection. The procedure of cutting down on the veins of children may be used but parents occasionally object to this because unsightly scars may result. Then too if the physician only occasionally performs transfusion by cutting down on the vein there is a strong possibility that the vein may be injured and that an unsuccessful attempt to administer blood may result.

Aortic puncture has been performed previously on adults for the purpose of making arteriographic studies of the abdominal and pelvic organs and of the lower extremities, by injecting into the abdominal aorta an opaque substance which may be visualized roentgenologically. In addition, various aniline dyes have been injected into the abdominal aorta for the purpose of combating peritonitis. It was felt that by this procedure a greater concentration of antiseptic solution could be brought in contact with the region involved than could be accomplished if the aniline dye were injected intravenously. It occurred to me that if the procedure were simple enough the administration of blood to infants and young children might be satisfactorily accomplished by means of puncture of the abdominal aorta.

TECHNIQUE OF AORTIC PUNCTURE

The patient is placed in the ventral decubitus position or he may lie on the left side with the head flexed toward the thorax and both knees brought up toward the abdomen (Fig. 1). The site of injection is usually at the level of the twelfth thoracic vertebra but it may vary from the tenth thoracic vertebra to the second lumbar

From the Sect on on Anesthesia The Mayo Clinic
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vertebra. The midline of the vertebra is palpated and a cutaneous wheal is raised with a 0.5 percent solution of procaine or of metycaine, at the level of the twelfth thoracic vertebra, just below the twelfth rib and at a point approximately 5 centimeters from the midline. In cases in which the patients are newborn infants or infants less than 3 months of age a special needle of No. 21 gauge and about 50 millimeters in length which has a bayonet lock is introduced through the cutaneous wheal toward the body of the vertebra. When the body of the vertebra has been contacted the needle is withdrawn slightly and introduced deeper into the tissue tangentially with the body of the twelfth thoracic vertebra (Fig. 1). As the point of the needle approaches the anterior portion of the body of the vertebra it is very close to the abdominal aorta, and by advancing the needle $\frac{1}{4}$ to $\frac{1}{2}$ inch (0.64 to 1.27 cm.) further, a throbbing sensation may be felt in the needle which will indicate that the aorta is in close proximity and that a slight thrust anteriorly will cause the needle to enter the abdominal aorta. It should be pointed out that the injection should not be attempted from the right side inasmuch as one would contact the vena cava which is not as suitable a site for injection as is the abdominal aorta. When successful puncture of the aorta has been accomplished bright red blood will drip from the end of the needle as the caliber of the needle is small there will not be any gush of blood from the lumen of the needle. In addition the systolic pressure in this portion of the abdominal aorta is about 50 to 80 millimeters of mercury. In other words, it is equivalent to the average diastolic pressure in the arm. As there is a definite pressure to overcome I have found it most satisfactory to administer the blood by means of a syringe which is fastened securely by means of the bayonet lock. The citrate method of transfusion is used because of its simplicity. The amount of blood administered by this method will vary according to each individual case, but as much as 200 cubic centimeters may be given easily and within a half hour. I have had the opportunity to inspect the abdominal aorta in 2 cases in which death resulted from systemic dis-

through collateral branches Examination of the injected cadaver showed the uterine arteries definitely filled with barium, apparently through the ovarian arteries This work is being carried further and will be reported later

Dr. Shafiroff pointed out that collateral circulation, following ligation of the internal iliacs, is supplied in the following manner

- 1 The uterine arteries which come from the internal iliac arteries, anastomose respectively with the right and the left ovarian arteries

- 2 The superior hemorrhoidal arteries, arising from the inferior mesenteric artery, anastomose with the inferior and middle hemorrhoidal arteries, which come from the internal iliacs

- 3 The pubic branches of the obturator artery, which is a branch of the internal iliac arteries, anastomose with the inferior epigastric arteries, which are branches of the external iliacs

- 4 The circumflex and perforating branches of the deep femoral artery, have collateral branches with the inferior gluteal arteries, which come from the internal iliacs

- 5 The superior gluteal arteries from the internal iliacs anastomose with the lateral sacral artery

- 6 The ilio-lumbar arteries from the internal iliacs, anastomose with the lumbar arteries, which come from the aorta

7. The lateral sacral arteries anastomose with the middle sacral artery.

- 8 The vesical arteries receive branches from the uterine and vaginal arteries

The value of ligating the internal iliac arteries in operations for the removal of the rectum in carcinoma cases is well illustrated by a case under supervision in the spring of 1937

An adult, white female, 64 years old, presented herself with the statement that she was suffering from hemorrhoids which were bleeding, and she wished relief from the bleeding, and assurance that there was no further trouble Questioning elicited the fact that bleeding had been free for 2 months, and that she had lost 20 pounds in 3 months There was the further history of unsatisfactory evacuation of the bowels and that no formed stools were passed The patient did not complain of any pain shooting down the legs nor did she complain of backache

Physical examination disclosed that the patient was pale, thin, nervous, and apprehensive The patient weighed 158 pounds, which figure represented 24 pounds less than her average weight The blood pressure was 130-80, the pulse was 82, and the heart was regular, of fair force, and showed no adventitious sounds The mucous membranes were distinctly pale A digital examination allowed the examining finger to enter about 3 inches, at which point there was a large, irregular fungoid growth filling the entire rectal lumen, with a passage through the center of this mass so small that it accommodated only one finger The mass bled freely on digital examination Proctoscopic examination confirmed the digital examination

and disclosed the mass to be so friable that tissue was disclosed by the end of the proctoscope The pre-operative work-up showed the blood count as follows hemoglobin, 65 per cent, erythrocytes, 3,900,000, leucocytes, 9,000, polymorphonuclear neutrophils, 61 per cent, lymphocytes, 37 per cent and monocytes 2 per cent The Wassermann test was negative The blood chemistry disclosed a blood sugar of 102 and non-protein nitrogen of 29 The x-ray confirmed the digital and proctoscopic examinations and showed the mass to be about 3 inches long, practically obstructing the entire lumen of the gut throughout the entire length of the growth Roentgenograms of the lungs, the spine, and the other bones did not disclose metastases

A preliminary left-sided colostomy was performed on May 17, 1937 At the time of this colostomy, the liver and other abdominal organs, were examined for metastases but no evidence was apparent A period of 28 days was allowed to elapse while the intestines were decompressed, and the patient's general health was built up

On June 14, 1937, the patient was transfused, and the growth was approached through a suprapubic midline incision under general anesthesia The continuity of the descending colon and sigmoid were terminated just below the left colostomy and the proximal end was invaginated as was the distal end, which was then carefully protected to prevent further contamination The mesocolon from this point, down to the promontory of the sacrum, was ligated and cut At this stage in the operation, the step which was of particular interest was then carried out The posterior peritoneal covering of the common iliac artery, on the right side, was incised at the bifurcation The internal iliac was picked up from within out, by carefully passing a curved aneurism needle around it The internal iliac was clamped, doubly ligated, but not cut The same procedure was then carried out on the left side, thus stopping all pelvic circulation from the internal iliac arteries A wide bilateral dissection on either side of the rectum and rectosigmoid was then carried out, down to the division between the rectum, and the uterus, and the vagina The sigmoid was then grasped, and the mesocolon of the sigmoid was put under tension, as was the mesorectum The mesocolon was then cut and practically no bleeding was encountered A sponge, on a sponge stick, was used to free the loose cellular tissue in the curve of the sacrum This gave complete exposure down to the growth, and it was then possible to pass the hand completely around the rectum, as there were no adhesions to the uterus, or to the vagina, or to any of the lateral structures, due to the bilateral dissection The absence of bleeding was striking, and there was absolutely no problem involved in hemostasis It was not necessary to ligate the middle sacral artery Clamps were placed across the anal canal, well below the growth The anal canal was cut across with a phenol knife, and the rectum together with the growth and the sigmoid were removed through the abdominal incision The proximal end of the anal canal was whipped over and buried under a purse-string suture Drains were placed in the pelvis and to the distal end of the descending colon, and the wound was closed in layers The patient left the table in good condition Postoperative course was not unusual and was helped by infusions and irrigations through the colostomy, which had been established for 28 days The patient is alive and well and so far has justified the procedure after 8 months

The points of particular interest are

In certain cases it is possible to ligate both internal iliac arteries, without jeopardizing the life of the patient.

CARCINOMA OF THE RECTUM AND RECTOSIGMOID LIGATION OF THE INTERNAL ILIAC ARTERIES

HAROLD BROWN KEES M.D., F.A.C.S. New York New York

HEMOSTASIS in operations for cancer of the rectum and rectosigmoid is a problem which in times past has prolonged the time of operation in some cases. The patient suffers not only from prolongation of operating time but from loss of blood. Hence any method which will render the problem of hemostasis easier is worthy of consideration. With this in mind the suggestion was made that preceding the removal of cancer from this region the internal iliac arteries be ligated. Especial stress is laid on this point, as while neither new nor original, it is not done as a routine measure for cancer of the rectum and rectosigmoid.

Ligating the internal iliac arteries seems so radical that one is impelled to consult a textbook on anatomy to refresh his mind and to recall that in the pelvis among the arteries which come from the internal iliacs are the vesical, uterine, inferior hemorrhoidal, and the obturator. Collateral circulation supplies the necessary blood to other pelvic organs when the internal iliac arteries are ligated.

The literature has been searched to see if the procedure of ligation of the internal iliacs has been recommended or practiced elsewhere. Our search proves the old contention that there is little that has not been tried before. The oldest reference discovered by the writer is noted as follows. Damon B. Pfeiffer in the 'Annual Oration in Surgery' before the Philadelphia Academy of Surgery, March 7, 1927, stated:

'Queau in October 1896 operated successfully upon a woman of 30 years, and separated the perineal from the abdominal stage of the operation by an interval of 6 days. This is the first instance of the two stage operation which has of late years been extensively employed in various forms. He did much to standardize and popularize the combined operation and it is generally known by his name. He emphasized the importance of asepsis and good hemostasis. He advised preliminary ligation of the internal iliac arteries but this step has now been abandoned in most quarters as unnecessary.'

A later reference is in Ravdin's translation of Kirschner's *Operative Surgery*, in the 1933 edition page 444 in which he states:

From the Surgical Service, French Hospital.
Read in part and case presented at the New York Academy of Medicine December 3, 1937.
Ann Surg. 19, 7 September.

'If amputation of the rectum has been decided upon as a single stage operation it is advisable as the first operative measure to ligate both internal iliac arteries since this greatly lessens the bleeding during the freeing of the rectum from the pelvic wall. However if a resection is planned the ligation of these two vessels should be omitted since they give rise to the middle and inferior hemorrhoidal arteries supplying the rectum.

The latest reference the writer has found to ligation of the internal arteries in cancer surgery, is the case operated upon October 27, 1937, in the Michael Reese Hospital, Chicago, during the Chical Congress of the American College of Surgeons by Dr. William Rubovius. In a personal communication he states:

Bilateral ligation of iliacs has been done in Michael Reese Hospital only for the relief of uncontrollable uterine bleeding in carcinoma. I have done the operation 3 times. The total number in our department is 6. When the vessels have been divided between ligatures (5 cases) bleeding has stopped immediately. The patient's condition improves rapidly. My hope is that the procedure may prove valuable when done extraperitoneally if possible or transperitoneally, when the problem presents itself in the course of a uterine operation accompanied by almost uncontrollable bleeding. This has occurred twice in my experience when fibroids invaded the retroperitoneal space.

So it is shown that the procedure practiced by Queau in 1896 and by other able surgeons, then abandoned as unnecessary, is again finding a useful application. It would be extremely helpful in cases in which the perineum, anus, levator ani muscles and related structures are to be removed.

A piece of original research on the collateral circulation of the pelvis and perineum was carried out as the result of the outcome of my recent case, in which the internal iliac arteries were ligated for cancer of the rectum and rectosigmoid. Dr. Arthur M. Wright, professor of surgery and Dr. Benjamin G. P. Shafiroff of the department of experimental anatomy at New York University Medical School made this possible through their co-operation. The cadaver of a recently deceased infant was used. The internal iliac arteries were bilaterally ligated. The abdominal aorta above the inferior mesenteric artery was injected with barium solution. An x-ray was then taken to observe what collateral circulation had taken place. Perineal circulation is obviously present.



Fig 1 Retainer or immobilizer

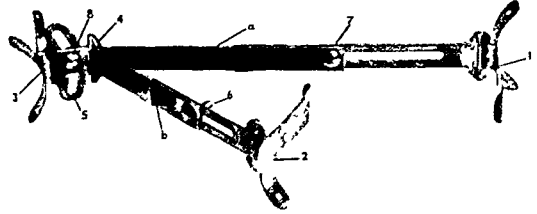


Fig 2 Retainer or immobilizer

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though the retainer
One would hesitate,
patient away with an
at a cash deposit, and
is unable to make that

Only one size necessary Due to the fact that this splint can be adjusted to fit both adults and children, it is necessary to have but one size The economy of this feature is at once apparent

I have already indicated that well leg traction splints in general are often economical splints and that this one in particular is especially so In support of this statement, let me mention other uses of this splint which make it almost a universal one as far as the long bones are concerned This feature makes it unnecessary to have an expensive outlay of arm and leg splints

FRACTURES OF THE LOWER LEG

Figure 6 illustrates how the tractor is used as a distractor for reducing fractures of the lower leg, by attaching a simple extension bar which pushes on the Kirschner bow. A Steinmann pin is drilled through the upper and lower fragments of the



Fig 3 Tractor and retainer applied in a case of compound fracture of the right femur Diagonal bar of retainer disconnected

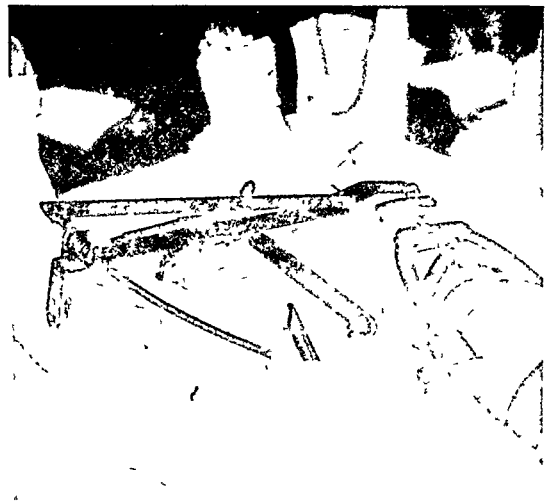


Fig 4 Tractor and retainer applied in a case of compound fracture of the right femur Diagonal bar of retainer disconnected

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HAROLD BROWN KEYES, M.D., F.A.C.S. New York New York

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A MODIFIED WELL LEG TRACTION SPLINT AND DISTRACTOR COMBINED

CHARLES H. WATT, M D , F A C S., Thomasville, Georgia

THE use of the well leg as a means of counter traction in certain fractures of the femur, and pelvic bones, has been established as a sound principle and a popular method of treating these cases since Anderson (1), published a description of his practical and ingenious splint. Other splints, somewhat similar in design, have appeared on the market since that time.

It is not the purpose of this article to relate further evidence of the effectiveness of this type of splint but to describe a modified well leg traction splint devised and used by the writer for the past 2 years, which in addition to possessing certain advantages over other such splints is also an efficient distractor.

DESCRIPTION OF THE SPLINT

The writer's splint is in two parts, one known as the tractor, Figure 1, and the other as the retainer or immobilizer, Figure 2.

The tractor is composed of two upright metal bars, 1 and 1, attached to removable plates, 2 and 2, for incorporation in plaster-of-Paris. Each upright bar is attached to the cross arm, 3, by a sleeve so that it can be moved along to any desired position, to fit any size leg, there to be anchored by thumb screws, 4. At one end of the cross bar, 3, there is a pivot, 5, and on the other end a swivel, 6. To the long cross bar, 3, a lever, 7, is attached through an eye which fits over the pivot, 5. This lever is adjusted for right or left leg simply by detaching and turning it over. It is composed of a short arm and a long arm, being in relation of approximately 3 to 1. At the long end of the lever, 7, there is a threaded bolt which passes through the swivel, 6, and carries a stout spring, 9, and a wing nut, 8. In the short end of the lever are several holes through which an S-hook, 10, a bolt or a piece of stout wire can be passed to connect the lever with a Kirschner bow, as will be explained.

The retainer, or immobilizer, consists of two metal bars *a* and *b*, both of the extension type. These bars, at their free ends, are connected by hinges to T-shaped metal bands, 1 and 2, for incorporation in plaster-of-Paris. At the other end, 4, these bars are connected by a hinge, but the

shorter, or cross bar, extends slightly beyond the hinge joint to connect with a quadrant, 5. The quadrant, 5, in turn is connected to the third T-shaped metal band through a hinge joint. The quadrant permits rotation of the injured member, cross bar *b* permits the desired separation of the feet while diagonal bar *a* controls the extension as explained below.

METHOD OF APPLICATION

Fractures of the femur and pelvic bones. A plaster-of-Paris cast is applied to the well leg, as for other types of well leg traction splints, extending from the toes to mid thigh. In addition to the pads over the knee, malleoli, and sole of the foot, a pad is placed over the inner side of the knee to prevent possible pressure from the metal T-band, 1, of the retainer in case pressure is applied before the cast is hard. This cast is allowed to become reasonably firm and then the retainer is attached by securing the metal T-bands, 2 and 1, just above the internal malleolus and opposite the inner condyle of the femur, respectively. These are held in place by several turns of plaster-of-Paris bandage. Some form of light anesthetic is now given and a Steinmann pin 8 inches long is drilled through the lower end of the tibia and a Kirschner wire through the lower end of the femur of the injured leg. Of course, a Steinmann pin may be used here instead of the Kirschner wire, if preferred. A well padded plaster-of-Paris boot is now applied extending from the base of the toes to the knee and surrounding the lower pin. As soon as the cast is firm the retainer is secured to it by attaching the third metal T-band, 3, just above the internal malleolus with the Steinmann pin passing through the small hole located in the center of the cross arm of the metal band, 3. When this is securely bound with plaster-of-Paris to the plaster boot, manual traction is gently applied to the injured leg with the wing nut, 7, on the long diagonal bar *a*, unscrewed. As soon as the leg is pulled down as far as possible, wing nut 7 is tightened, thus holding what has been gained by traction, and wing nut 8 on the quadrant is unscrewed, the foot is rotated into the position which is desired and the wing nut 8 is then tightened again (Fig 3).

Thus in selected cases, the rectum may be removed from above without danger of hemorrhage.

The patient is saved a prolonged illness, which would result if sacral or perineal approach were required.

Finally, the patient is spared the shock, the pain and a prolonged healing process, which would be required in the posterior approach.

While the procedure of ligating the internal iliac arteries in surgery of the rectum and rectosigmoid is not the method usually practiced, our case proves that it is of invaluable assistance in selected cases. Leaving the perineum intact also violates the fundamental thesis of Miles that all three paths of lymphatic spread should be thoroughly extirpated even in early cases of carcinoma. However, violating Miles' thesis has been successfully done by such men as Mayo, Fankin, Jones, Lahey and others, who have led the way in rectal surgery in this country in recent years. Leaving the perineum intact is further justified by the work of Westhues.¹ He disputes Miles' thesis of the downward spread of cancer of the rectosigmoid. In support of this he made most extensive microscopic examinations on the pathological tissues removed in 102 different cases of cancer of the rectum done by the radical abdominoperineal method which included removal of the sphincter. In only one case did they find metastases below the lower edge of the neoplasm. This will prove to be either a very helpful suggestion, or disastrous for some patients if incorrect.

Further search of the literature on ligation of the internal iliac arteries discloses the fact that this operation was performed by Dr. Howard C. Taylor Sr. and his associates in 1924. This was done to control bleeding in a case of carcinoma of the uterus.

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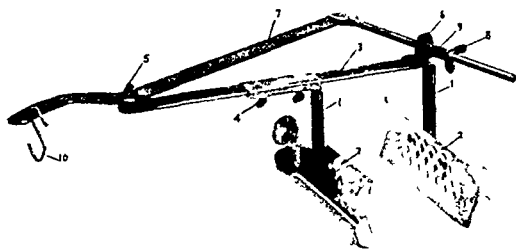


Fig 1 Tractor fully described in text

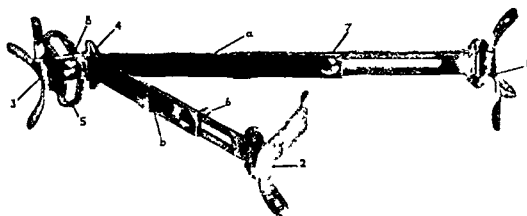


Fig 2 Retainer or immobilizer

doctor is limited to the number of splints the hospital or doctor can afford. In the writer's splint the patient is dismissed wearing only the retainer (Fig 3) which is a very simple inexpensive device. Personally, we have had as many as five retainers on patients at the same time, most of them out of the hospital and the tractor available for use should another case come in. In this instance one tractor served five retainers.

Not infrequently cases are brought into the hospital, with fractures of the femur, who live quite a distance away and are not able to pay even a small hospital fee. Is the hospital to carry such a patient until the fracture is healed, or put a splint on him and send him on his way? With a retainer on such a case, especially if the plaster-of-Paris cast is extended up to the hips on each leg and braced across the top with a wooden strip incorporated in the plaster, such a case can be transported great distances safely. It would be a great saving to the hospital though the retainer should never be returned. One would hesitate, however, to send such a patient away with an expensive splint on without a cash deposit, and the type case referred to is unable to make that deposit.



Fig 3 Retainer applied, ready for tractor. This also illustrates the appearance of the splint when patient is dismissed.

Only one size necessary. Due to the fact that this splint can be adjusted to fit both adults and children, it is necessary to have but one size. The economy of this feature is at once apparent.

I have already indicated that well leg traction splints in general are often economical splints and that this one in particular is especially so. In support of this statement, let me mention other uses of this splint which make it almost a universal one as far as the long bones are concerned. This feature makes it unnecessary to have an expensive outlay of arm and leg splints.

FRACTURES OF THE LOWER LEG

Figure 6 illustrates how the tractor is used as a distractor for reducing fractures of the lower leg, by attaching a simple extension bar which pushes on the Kirschner bow. A Steinmann pin is drilled through the upper and lower fragments of the

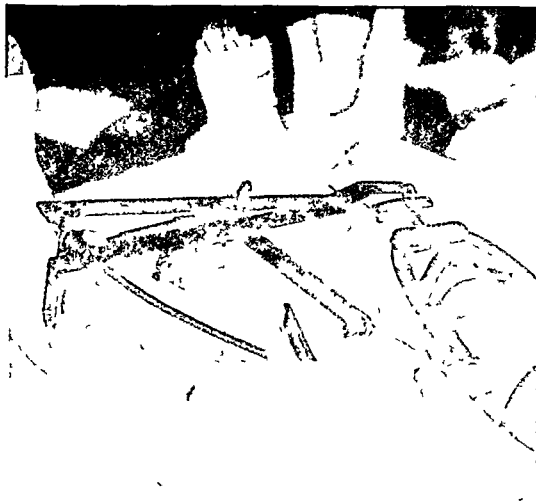


Fig 4 Tractor and retainer applied in a case of compound fracture of the right femur. Diagonal bar of retainer disconnected.

The tractor is now applied to the well leg plates 2 and 2 fitted on the cast of this leg between the attachments 1 and 2 of the retainer. A few turns of plaster of Paris or surgical gauze is sufficient to hold this in place. Some form of Kirschner bow is now attached to the wire in the femur. If a Steinmann pin is used instead of a Kirschner wire the bow is unnecessary. Wing nut 8 of the tractor is now run out as far as necessary on its threaded bolt to allow connection between the Kirschner bow and S hook 10. Traction is obtained by screwing down on wing nut 8 after unscrewing wing nut 7, on the diagonal bar *a* of the retainer (Fig. 4).

In this splint an attempt has been made to overcome the objections commonly raised against well leg traction splints namely (1) the risk of permanently loose joints or habitual dislocation due to pull through the knee joint (3) (2) risk of overextension due to constant steady pull (1), and (3) pain in the hip joint of the well leg due to excessive pressure against these structures (1). In the writer's splint the first two of these objections have been overcome and the third has been reduced to a minimum being absent entirely in most cases.

Direct pull. It will be evident from the above description that the pull is directly on the fractured bone, the femur, which we believe to be preferable to a pull through the knee joint with its attendant risk of stretching the joint structures. If the fracture is too low down in the femur however the pin, or wire is placed through the upper end of the tibia and the apparatus is attached with the knee of the injured leg slightly flexed (Fig. 5).

Risk of overextension eliminated. In this, as in any method of constant steady traction, shortening is frequently overcome within a few days and satisfactory reduction is obtained. With the traction part of the splint separate from the immobilizing part, as in this splint constant steady traction can be discontinued at any point and the tractor removed leaving only the retainer as shown in Figure 3. In this way we have eliminated the risk of overextension of the fragments with its danger of delayed or perhaps non union. As soon as sufficient traction has been obtained wing nut 7 on the retainer is tightened, wing nut 8 on the tractor loosened and the tractor, Kirschner bow, and wire (or Steinmann pin if used) through the femur are removed. The stress is now thrown on the foot of the injured leg but because of the Steinmann pin incorporated in the plaster and passing through the metal splint the pressure which is put on the heel and dorsum of the foot is negligible.

As described by Anderson, traction by this method results in abduction of the injured leg and adduction of the well leg. With the two legs in this position and the fractured leg drawn out to its normal length, it will appear longer than the well leg. A cross bar connecting the two inner malleoli forms an acute angle with a diagonal bar extending from the inner malleolus of the fractured leg to the inner condyle of the femur of the well leg. As long as this angle remains acute shortening of the fractured leg cannot occur unless the patient increases the abduction angle at the hip which he is not likely to do. The usual inclination is to straighten up. This acute angle is obtained by the tractor and maintained by the cross bar *b* and the diagonal bar *a* of the retainer which become rigid bars when wing nuts 6 and 7 are tightened. This is the principle of the retainer.

Pain in the hip of the well leg eliminated. Considerable pressure can be exerted against a hip when the leg is in abduction without causing the patient discomfort because the pressure is against the bony framework, the acetabulum. With the leg in adduction however, the pressure is more against the capsule and ligaments and causes considerable discomfort at times. This objectionable feature of well leg traction splints is mentioned by some writers and suggestions are offered for its remedy. Anderson (2) states that in some cases the pain is so severe it may demand temporary release of traction. In the writer's splint this objectionable feature has been practically eliminated by placing the fulcrum much nearer the end of the lever to which the weight (traction) is attached than it is to the other end where the power is applied. The relative length is about as 1 is to 3 hence the pressure on the well hip is only one third as great as the pull on the injured leg. This amount of pressure is not enough to produce noticeable discomfort.

Convenience. The fact that this splint is applied within the confines of the patient has made it possible to use it where other types were not practical. One such instance was the case of a man 6 feet 7 inches tall with a compound fracture of the left femur. Even with the head end of the bed cranked up it was difficult to get this man into the regulation hospital bed. There was no room to add 6 inches of splint beyond his feet. The writer's splint was employed successfully in this case.

Economy. Undoubtedly the well leg traction splint often effects a saving to the patient in hospital expense because he can be moved to his home much earlier. However the number of patients treated in any one hospital or by any one

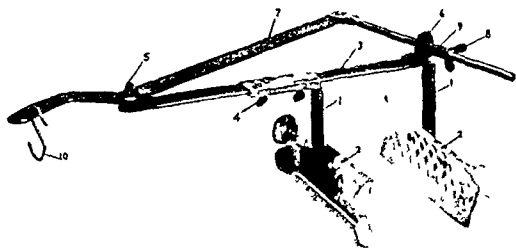


Fig 1 Tractor fully described in text

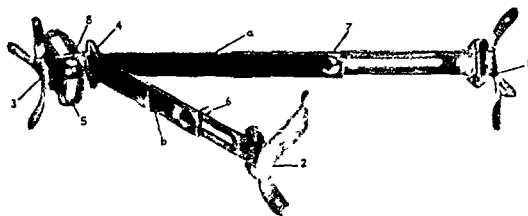


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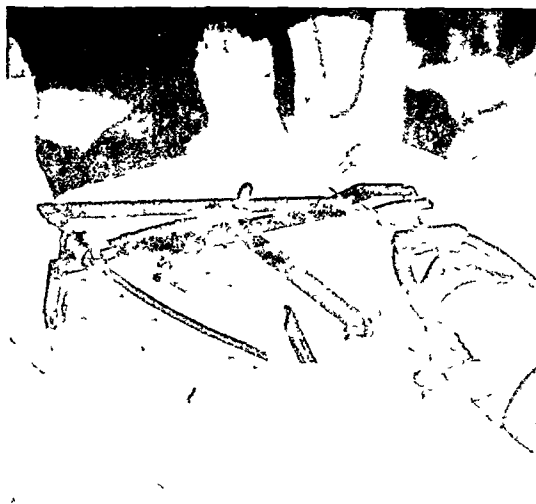


Fig 4 Tractor and retainer applied in a case of compound fracture of the right femur. Diagonal bar of retainer disconnected.



Fig. 5 Fracture lower end of left femur. Splints applied showing how flexion is obtained for this type of fracture. This picture was made just before tractor was removed hence the plaster of Paris extension above the knee of left leg.



Fig. 6 Tractor converted into a distractor for reduction of fracture of both bones of the lower leg by attaching an extension rod to the long arm of the lever.

tibia. These are incorporated in plaster of Paris, leaving a gap at the fracture site or the entire leg may be incased in plaster of Paris and a circular cut made half way between the two pins as suggested by Miller. The tractor is then fitted on the upper cast with this pin passing through holes in members 2 and 2. A few turns of plaster will hold this in place. A simple extension bar, possessing an attachment for rotation in case the two pins are not parallel is now affixed to the long arm of the lever on the tractor by one end and to some form of Kirschner bow at the other. Screwing down on wing nut 3 produces effective distraction and the rigid bar makes a substantial support for the leg so that it can be moved about without pain to the patient and without fear of disturbing the fragments. If the wound is compound dressings are easily done. As soon as reduction is satisfactory small blocks of wood are placed in the gap, a posterior molded plaster splint is applied and allowed to set after which the tractor is removed and a few turns of plaster makes a firm cast. The Steinmann pins are preferable to the Kirschner wires in these cases because of their rigidity.

REDUCTION OF THE ARM

Figures 7 and 8 illustrate the use of the tractor as a distractor in cases of fractures of the humerus and both bones of the forearm. As shown in Figure 7 a shoulder spica of plaster of Paris is first put on with the arm held in the most favorable position as determined from radiographic films. The cast is carried far enough down the arm to afford room to attach the members of the tractor. Detachable members 1 and 2 are left off. A few turns of gauze bandage will hold the tractor secure. A 6-inch Steinmann pin is now

drilled through the ulna near the olecranon process (or through the lower humerus) and with the forearm at right angle to the upper arm a plaster of Paris cast is applied from the hand to and including the elbow, incorporating the pin. The extension rod is attached to the long arm of the lever as for the lower leg and a small right angle bar of special design is fitted to this rod. Some form of Kirschner bow is attached to the pin and connected to the right angle bar as shown in Figure 7. The hand is supported by a sling from the short arm of the lever. The extension rod splints the fracture and rotation is provided for in the same rod. Extension of the humerus is accomplished in the usual way by screwing down on wing nut 3. Reduction may be carried out at once under fluoroscopic guidance the gap between the casts filled in with plaster after which the entire mechanism is removed. Reduction by this means is a great saving in hospital expense to the patient because of early dismissal.

Figure 8 illustrates one way of attaching the tractor for obtaining extension in fractures of the radius and ulna. The forearm is held at right angle to the upper arm, a plaster of Paris cast is applied to the upper arm around the elbow and far enough down the forearm to form a base for the attachment of the two upright bars 1 and 2 of the tractor. The same pin rod used for fractures of the humerus is attached by one end to

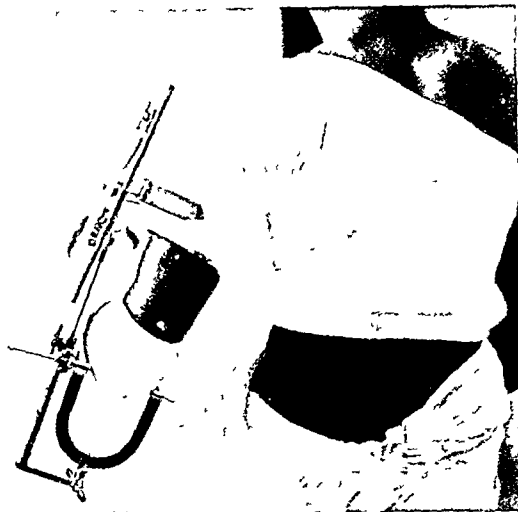


Fig 7 Tractor used as distractor in reducing a fracture of the humerus

the long arm of the lever, 7, and by the other end to finger traps attached to the fingers. If skeletal traction is preferred a Kirschner wire or Steinmann pin is put through the lower end of the radius and to this is attached a Kirschner bow for connection with the right angle bar. Extension in either method is obtained by screwing down on wing nut 8. Reduction can be carried out under the fluoroscope if desired and when satisfactory the cast can be continued over the rest of the forearm and hand and, when this is hard, the apparatus is removed. The extension bar necessary to convert the tractor into a distractor is simple and inexpensive when compared to the cost of the apparatus usually employed as a distractor. Most hospitals and surgeons doing fracture work are equipped with some form of Kirschner bow, hence no added expense is incurred here.

TRACTURES OF THE NECK OF THE FEMUR

Intertrochanteric Experience has shown that most of these fractures result in bony union if securely held for 10 to 12 weeks, sometimes earlier. Hence we employ the well leg splint in these cases. The "retainer" is applied in the regular way and reduction made by manual traction at once and the wing nuts tightened, or the routine for fractures of the shaft may be employed.

Intracapsular fractures Most writers, including Magnuson, express disappointment over the results obtained in these cases treated with a well leg splint. Junkin, however, reports 38 cases of hip fractures treated in this way, 15 of which were



Fig 8 Manner of applying the tractor for reducing fractures of the forearm, or a pin may be put through at the wrist and a Kirschner bow applied

intracapsular and "all living past a year recovered with bony union and good function." Magnuson suggests that failure might be due in part to continuous traction. By using only the retaining part of the writer's splint in those cases following reduction by the Ledbetter method, it is an easy matter to maintain good position of the fragments, but failure of union often results despite the fact that there is *no traction at all* with this splint used in this way. Some of these cases may develop bony union as late as a year but it is not practical to keep a splint on that long. Hence this splint is not used for intracapsular fractures unless they are of the impacted, incomplete type. This type, it is true, will usually heal firmly if the patient is left alone in bed without splints of any kind but there is the danger of completing the fracture. Besides there is usually a certain amount of external rotation of the foot. Application of the retainer in the usual manner, *without* the insertion of a pin or wire (since there is no muscle pull) and with internal rotation of the foot to 20 degrees, enables the patients to get out of bed and into a chair without danger of completing the fracture and when healing is completed the external rotation of the foot has usually disappeared.



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cause an ulceration of the intestinal or gastric mucosa, however, these are purely academic discussions and no definite proof has been brought forth to substantiate this theory.

It is the commonly accepted belief that aberrant pancreas is of congenital origin. The objection to this theory is mainly based upon the following reasons. (a) the finding of pancreatic tissue during postmortem examinations of newborn children is very rare, and (b) most of the patients, in whom this condition was found at the time of operation, were of the second decade of life or older, however, these objections to the theory of congenital origin do not seem to be valid in the light of recent postmortem observations.

In a series of 19 postmortem examinations reported by Branch and Gross, 5 instances, or 25 per cent, were in newborn children, the ages varying from 8 weeks to 3 months, a fact showing definitely that the presence of this tissue in the newborn is not as infrequent as it is thought to be, furthermore, one must take into consideration the fact that while aberrant pancreatic tissue is easily recognizable macroscopically in postmortem examination of an adult, because in the adult it has attained a fair size, it can be diagnosed only on microscopic examination in the newborn. Therefore, in infants, it frequently goes unrecognized in the ordinary postmortem inspection. Such tissue may remain dormant for many years in the early life of an individual and then suddenly give rise to clinical symptoms of varying intensity.

The relative frequency of the presence of aberrant pancreatic tissue based upon the finding in 4,076 autopsies reported by 6 different pathologists (6), varies between 0.55 and 3 per cent, the average being 1.89 per cent. The most common site is the stomach and duodenum, about equally divided—31 per cent each, the next most frequent locations are the jejunum, 21 per cent, ileum, 9 per cent, peritoneal lining, 3.37 per cent, and the least common location of this condition is the gall bladder and spleen, 1.48 per cent and 0.74 per cent, each.

Aberrant pancreatic may be generally divided into two types (a) the annular pancreas and (b) the aberrant pancreatic nodule.

The annular pancreas is a rare developmental anomaly in which the viscus is situated normally but encircles in a ring-like fashion the second portion of the duodenum, thus giving rise to a constriction of that portion and a dilatation of the portion above it. This condition has a distinct clinical significance, because of its tendency to cause stenosis, and in some instances it has pro-

duced all the signs and symptoms of high intestinal obstruction. McNaught and Cox collected from the literature and tabulated 44 cases, in 9 of these cases signs and symptoms of high intestinal obstruction of various degrees were present. Therefore, this condition must be kept in mind whenever symptoms of high intestinal obstruction present themselves. In most of the cases in this group the annular pancreas were incidental autopsy findings. There was nothing in the history of the patients to indicate that this anomaly caused them to suffer any gastro-intestinal discomfort during life. The symptoms of acute intestinal obstruction which result from such an anomaly probably arise after "swelling of the pancreatic ring through hemorrhage, pancreatitis, tumor, hypertrophy, etc.," have taken place.

Aberrant pancreatic nodules. A more common form of aberrant pancreatic tissue, the one with which this communication is chiefly concerned, is the small nodule varying in size from several millimeters to 6 centimeters in diameter. Such nodules may be situated either on the wall of the stomach, duodenum, jejunum, or in an intestinal diverticulum. Several observers have reported the presence of small nodules in the hepatic duct, the gall bladder, and omentum. The most common site, however, is the duodenum, the jejunum, and the walls of the stomach, as stated above.

The various theories as to the origin of the accessory pancreatic tissue have been thoroughly covered by other writers and will not be repeated here. Our purpose in writing this paper is to report 2 more cases of this anomaly and to present a brief review of the literature. The importance of bearing in mind this condition as a distinct clinical entity in the interpretation of symptoms referable to the gastro-intestinal tract and of recognizing it at the time of operation will be clearly shown from the findings in these cases.

Many surgeons, including the writer, have had the unfortunate experience of mistaking aberrant pancreatic tissue for a carcinomatous lesion of the stomach or intestine. Considerable local inflammatory reaction at the site of aberrant pancreatic nodules will produce symptoms simulating those of pyloric or duodenal ulcer and at times even at operation the true condition will not be recognized.

In several recorded instances, risky operative procedures could have been omitted if correct diagnoses had been established either before operation or at least at the time of operation. In 10 of the 28 cases reported in the most recent American literature aberrant pancreatic tissue was

SUMMARY

A combination well leg traction splint and dis tractor is described the technique for its application is given in detail and its several advantages set forth

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ABERRANT PANCREATIC TISSUE IN THE GASTRO-INTESTINAL TRACT

Report of Two Cases and Review of Literature

MAX DANZIS, MD, FACS, Newark, New Jersey

ABERRANT pancreatic tissue is still particularly considered an infrequent anomaly. To Klob is given the credit of having described the first case in 1859 (2). Since that time a number of cases have been reported in the medical literature particularly within the last decade. In most instances the finding was made at autopsy examination apparently the tissue not having produced clinical symptoms denoting its presence.

The presence of aberrant pancreatic tissue is rarely suspected before operation; indeed a careful perusal of the reported cases shows that with few exceptions its presence was not recognized at the time of operation. The pre-operative symptoms resulting from aberrant pancreatic tissue were usually interpreted clinically as being caused by peptic ulcer, by cholecystitis or even by malignancy.

The first cases recorded in the literature in which the syndrome of the symptoms produced by aberrant pancreatic tissue was given presumably as the indication for operation were those of Hulst, Leyden and Reynier and Masson 1909 (6). Hulst found pancreatic tissue in a Meckel's diverticulum. In the cases of the others operation was undertaken to relieve suspected cancers of the pylorus during the course of the operation, however aberrant pancreatic tissue was found which without doubt had been the cause of the clinical symptoms. Many similar observations have since been made much to the

chagrin of the surgeon who in the course of operation for instance, in the case of a suspected duodenal ulcer or some other upper abdominal condition discovers aberrant pancreas or aberrant pancreatic tissue which would explain the patient's symptoms.

In his review of 43 cases in which aberrant pancreas were found at the time of operation Pappi states that the most frequent pre-operative diagnosis was either gastric or duodenal ulcer. This diagnosis was made in 17 cases or 39.5 per cent. The aberrant pancreatic tissue in these 17 cases was found in the stomach, jejunum, gall bladder and Meckel's diverticulum. In 10 of the 43 cases no specific diagnoses were made; 7 were either diagnosed as stones, hepatic colic or were vaguely described as pathology in the right hypochondriac region. The most common site of the aberrant pancreas in these 10 cases was either on the duodenal or gastric wall.

In this connection it is interesting to note that aberrant pancreas was considered by some as a possible etiological factor in the causation of duodenal ulcer. Scagliosi, quoted by Pappi, states that from several cases examined by him he was led to the conclusion that the aberrant nodules inclosed in the intestinal wall may produce an ischemia in this area through its compression effect which causes an atrophy of the mucosa and by its mechanical action may bring about atrophic disturbance of the nerve filaments thus leading to the formation of ulcer. Some believe that the digestive property of the pancreatic tissue may

at the rectal ampulla. Stool specimens on December 6 and 7 were strongly positive for occult blood. The patient was put on a Sippy diet after admission and felt fairly comfortable for a short time. A diagnosis of duodenal ulcer with possibility of early malignancy was made and operation was advised.

The operation was performed on December 11. Through an upper right rectus incision the abdomen was explored, the gall bladder was found to be normal, the stomach was normal, the pylorus appeared hard and retracted near the duodenal junction. On the first portion of the duodenum was found a small nodular growth of a cauliflower appearance, firmly incorporated in the duodenal wall, close to the retracted area. This finding, in conjunction with the history of occult blood and x-ray findings, led us to believe that we were probably dealing with a peptic ulcer and the possibility of early malignancy was also considered. A radical operation was therefore decided upon and a partial gastric resection of the Pólya type was done.

The postoperative course ran along very smoothly for the first 6 days. There was no vomiting or distention, the patient retained all fluids. On December 17, 6 days following operation, the patient vomited a foul-smelling reddish fluid, this was followed by some abdominal distention which was relieved by Levine tube. On the ninth day after operation, the temperature, which had never been above 101 degrees suddenly rose to 103.8 degrees and the patient went into sudden collapse. The pulse became rapid and thready and the skin cold and clammy. He remained in this condition until the next day when he went into extreme collapse and died on December 22, the eleventh day after operation.

Surgical pathology report by Dr William Antopol. The gross specimen consists of resected portion of stomach and proximal 1 centimeter of duodenum. The entire specimen measures 11 centimeters along the greater curvature and 4 centimeters along the lesser curvature. The mucosa of the duodenum is markedly injected and granular. There are clamp marks on the duodenal portion which obliterate a good deal of its architecture. Along the line of extension of the lesser curvature and incorporated in the wall of the duodenum extending to the submucosa, there is a nodule which is 1 centimeter in its circular diameter and 8 millimeters thick. On cut section this has the appearance of glandular elements in a fatty stroma.

Microscopical examination. Mucous membrane, in several places, is absent. In the mucosa, there are congested areas as well as areas containing an increase in polymorphonuclear leucocytes. Numerous islands of pancreatic tissue and ducts are present through all layers, including the mucosa, and extending outward so as to form a projection of the serosa. In these areas, the muscular bundles are sparse, the Brunner glands are displaced. There are also zones in which the ducts are almost the sole epithelial constituents. Some of these ducts are dilated and contain numerous polymorphonuclear leucocytes. An occasional duct shows a squamous cell metaplasia of the lining cells. The corresponding interstitial tissue contains many fibroblasts and polymorphonuclear leucocytes. A rare island of Langerhans is seen.

Microscopical diagnosis. Aberrant pancreatic tissue in the wall of the proximal portion of the duodenum with chronic duodenitis (Figs. 1 and 2).

Autopsy findings. Abdomen. Peritoneal cavity presents a grayish and greenish yellow stringy and purulent exudate at the root of the mesentery. The serosa of the proximal loops of the jejunum is thickened and dulled in appearance and it is covered by small and large flakes of stringy yellow material.

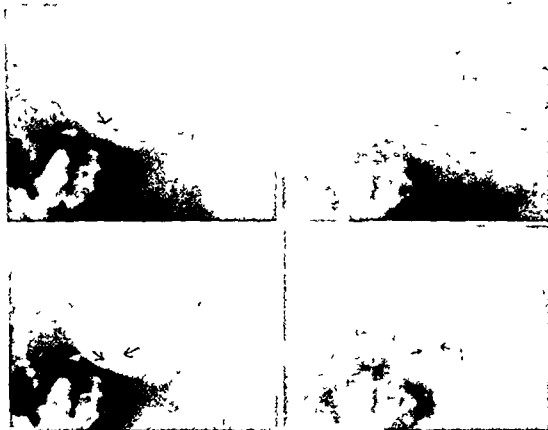


Fig. 3 Case 2 X-ray showing benign papilloma of pars pylorica

Gastro-intestinal tract. The antral portion of the stomach and the proximal few inches of the duodenum have been resected. The distal end of the stomach is found tightly sutured to a loop of jejunum. The gastro-enterostomy appears to be well closed and no opening can be seen in the line of suture. The proximal end of remaining duodenum is covered with a shaggy, dull, greenish black material which encroaches on the wall of the duodenum and onto the origin of the root of the mesentery, in the region of the ligament of Treitz. The duodenal stump appears well closed except at one point where there is a small opening about 3 millimeters in diameter which is partially plugged with greenish black material. The ascending colon is covered with patchy exudate of stringy, yellowish-green material.

Diagnosis. Leakage from duodenal stump with fibroid purulent peritonitis. Also localized patchy pneumonia right middle lobe and right lower lobe.

CASE 2. S. S., white female, aged 45 years, was admitted to the hospital on December 6, 1936, complaining of a continuous feeling of weakness and fatigue. This had been present for a period of several months. There had been no other complaints until 10 days ago, when she awoke with a severe headache which was accompanied by a feeling of nausea and repeated vomiting. No abdominal pain or distress was noted, a narcotic was administered, after which the acute symptoms disappeared. However, the sense of weakness and inability to do even light physical work seemed to be aggravated since the attack. Bowels, which were always regular, became constipated for several days following the acute incident, during this period for the first time she took cathartics. The remainder of her history was of no special significance.

Physical examination. revealed an extremely obese female. A rubbing systolic murmur was heard at the apex which was transmitted toward the base as well as toward the axilla. The rhythm was regular, no other positive findings were noted. Hemoglobin on admission was 95 per cent, red cell count, 4,850,000, white blood cell count, 5,900. Urine was essentially negative, Wassermann blood and Kline tests were negative.

X-ray examination of the gastro-intestinal tract before admission to the hospital was reported as indicating "probably early gastric malignancy." Examination at the hospital by Dr. N. J. Furst showed "the stomach to be of

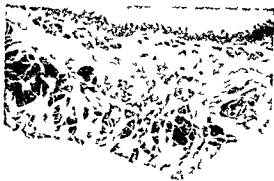


Fig 1 Case 1 Pancreatic tissue and ducts in wall of duodenum Low power



Fig 2 Case 1 Aberrant pancreatic tissue and ducts containing leukocytes $\times 125$

an operative finding in the remaining 18 cases the diagnoses were made at autopsy (1 2 3). The diagnosis was not made before operation in any of the 10 cases nor was the true condition recognized even at the operating table except in 1 case (8) its presence was only suspected at the time of operation in another case. In 2 of these cases partial gastric resection for a supposed carcinoma of the pylorus was done. Hemipylorotomy was performed in 2 other cases in which a pre operative diagnosis of duodenal ulcer was made and the exact condition was established only by microscopical examination of the tissue removed at operation. A pre operative diagnosis of gall bladder disease was made in one of these cases and cholecystectomy was done. A small tumor was observed in the stomach wall which was excised and upon microscopical examination proved to be pancreatic tissue. A resection of the pylorus was done in another case for pyloric obstruction of a supposedly inflammatory nature. In one case a pre operative diagnosis of appendicitis was made, but at operation a Meckel's diverticulum containing aberrant pancreatic tissue was found. In another case in which an operation for proved carcinoma of the stomach was done aberrant pancreatic tissue was incidentally found in the duodenum. The true condition was recognized at the time of operation in one case in which a tumor the size of a hazel nut was removed from the anterior duodenal wall with favorable post operative recovery.

It is therefore important to sound another note of warning to the unwary of the existence of this condition not so commonly known. Many surgical pitfalls are caused by anatomical anomalies which the surgeon encounters in the course of an operation. Constant reiteration of the existence of such anomalies will, in many instances, prevent

unfavorable postoperative results. This can be done most impressively and forcefully by reporting the surgical instances in which such anomalies have been encountered but not recognized. In many such cases the end results would have been obviated if the true condition had been recognized at the time of operation.

Up to the present writing 328 cases of aberrant pancreatic tissue were recorded in the literature. This does not include the 44 cases of annular pancreas reported by James B. McNaughton—a condition which is more easily recognized at the operating table than the irregularly distributed nodules of aberrant pancreatic tissue along the gastro-intestinal tract. A most comprehensive report of this condition with a careful tabulation of 300 cases reported in the literature was published by Arrigo Pappi (2). Since the publication of his article reports of 25 other cases have appeared in the literature (1 2 3 8).

CASE REPORTS

CASE 1 B. K. white male age 43 years was admitted to the hospital on November 20, 1935. His chief complaint was rectal bleeding. Family and past history were irrelevant. Present illness began about 3 months before admission when he noted several drops of blood in the stools. Since that time he had noticed on several occasions large amounts of blood in the stools which at times were dark red and sometimes black. He never had any sharp upper abdominal pain, nausea or vomiting. He had short periods of diarrhea having four or five stools per day which were followed by periods of constipation. For 3 weeks prior to admission the patient had no rectal bleeding but did have a dull ache over the entire abdomen. The patient gave no history of anorexia or loss of weight and his general physical examination at the time of admission to the hospital was essentially negative.

Report of gastro-intestinal series completed on November 29 showed probably duodenal ulcer with some pyloric retention. Barium enema showed some narrowing

duodenum was done. In view of the postoperative findings, it is extremely doubtful whether such a radical operation was a justifiable procedure in this case. A much simpler operation, such as gastro-enterostomy, could have probably relieved the patient's symptoms.

In Case 2, the aberrant pancreatic tissue with the enormously dilated glands undoubtedly was the cause for polyp formation. This was located in the prepyloric region and would act like a ball-valve. This might have been the cause of the pylorospasm, retention, and the onset of acute vomiting, which made the patient seek medical relief. The x-ray diagnosis of early malignancy and the subsequent more correct diagnosis of pyloric polyp were the deciding factors for surgical treatment.

The recognition of the benign nature of this structure, before and during the operation, obviated the necessity for any radical surgical procedure. A partial hemipylorectomy was performed and this procedure was followed by an uneventful recovery.

SUMMARY

The report of 2 cases, in addition to those previously reported by other writers, in which the presence of aberrant pancreatic tissue along the

gastro-intestinal tract was found, is presented. A brief review of the literature, indicating the infrequency with which this condition is diagnosed, either before or at operation, is given. The difficulty of making a correct pre-operative diagnosis and the importance of recognition of the condition, particularly at the time of operation, is pointed out so that such unfortunate results as were obtained in Case 1 may be avoided.

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Fig 4 Case 2 Polypoid lesion of stomach with pancreatic tissue and ducts within stomach wall. Low power

medium large size of active tone of good mobility and separability. No defect in pars cardia or media was observed. On the greater curvature side of the pars pylorica there was a more or less persistent area of circumscribed illumination probably due to polyp formation (Fig 3). Peristalsis was comparatively normal. Gastric evacuation was delayed resulting in retention of 40 per cent of the breakfast meal. At 24 hours the major portion of the barium had been expelled precluding a morphological description of the colon. Conclusion: pyloric polyp probably benign.

In view of the history of 10 days persistent vomiting followed by weakness and the report of the examinations of the gastro-intestinal tract both before and after admission to the hospital operation was decided upon. The pre-operative diagnosis was polyp of pylorus probably causing pylorospasm and obstruction.

The operation was performed on December 11. The abdomen was opened by an upper right transrectus incision. The external appearance of the stomach and duodenum was normal. There were no adhesions between the gall bladder, pylorus and duodenum. The gall bladder was small, not distended, no stones. After thorough palpation of the stomach a small soft mass was felt within the lumen of the pylorus. The entire stomach was pulled down and held to the parietal peritoneum below the umbilicus by omentum which was fixed in that position probably as a result of a previous operation. The pylorus was incised and the mass with a segment of stomach wall was removed. The incision was closed at right angles by two layers of catgut for peritoneum, interrupted chromic gut for fascia and silk suture for skin.

Postoperative course: Patient vomited some blood after operation and hemoglobin came down 10 per cent. A blood transfusion of 500 cubic centimeters was administered supplemented by intravenous injections of 5 per cent glucose during the next 48 hours. The subsequent postoperative course was entirely uneventful. The patient was discharged on January 4, 1935, in very good condition. The follow up several months later showed patient to be free from any gastro-intestinal symptoms.



Fig 5 Case 2 Aberrant pancreatic tissue and ducts. X165

Gross examination of the surgical specimen by Dr William Antopol. The specimen is of polypoid structure 1 centimeter in height and $1\frac{1}{2}$ centimeters in diameter. On cross section it was seen to be composed of a grayish yellow tissue arising from a broad pedicle. Numerous dilated duct-like lumina traversed the polyp and an occasional cellular area was seen in the muscularis and submucosa.

Microscopical examination revealed areas of pancreatic tissue through the muscularis and submucosa with dilated ducts in both the muscularis and submucosa. At times these dilations reached cystic proportions. No islands of Langerhans were noted.

The diagnosis of polyp of the stomach with aberrant pancreatic tissue and dilated ducts was made (Figs 4 and 5).

The object of reporting these 2 cases is to bring again to the attention of the profession the fact that aberrant pancreatic tissue is not as infrequent as it is commonly believed to be.

The unfortunate postoperative outcome in Case 1 illustrates very strongly the importance of being able to recognize and evaluate the significance of this condition before operation or at least at the time of operation. The absence of any other pathological condition in the gastro-intestinal tract in Case 1 as demonstrated by our operative exploration and subsequently supplemented by the post mortem examination and the microscopical diagnosis of aberrant pancreatic tissue in the wall of the proximal portion of the duodenum with chronic duodenitis proved conclusively to my mind that the clinical symptoms were entirely due to this condition. We were strongly influenced in the choice of operation because of the presence of the pancreatic nodule which probably caused the local inflammatory condition of the duodenal wall in that area. The general appearance of this pancreatic nodule together with the indurated area around it led us to suspect early malignancy. A resection of the pylorus and the first portion of

duodenum was done. In view of the postoperative findings, it is extremely doubtful whether such a radical operation was a justifiable procedure in this case. A much simpler operation, such as gastro-enterostomy, could have probably relieved the patient's symptoms.

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A RELIABLE CONTROL FOR STEAM STERILIZATION

CARL W. WALTER, M.D. Boston, Massachusetts

ALTHOUGH surgeons, well schooled in aseptic technique, recognize the basic importance of the sterilization of surgical supplies, they are not familiar with the actual technique of sterilization and assume it to be automatic and infallible. The responsibility for the preparation of surgical supplies has been delegated to others without the realization that those entrusted with supervision of the work have no reliable means of detecting faulty sterilization. More intimate knowledge of sterilizers and a brief consideration of the principles underlying the use of steam as a sterilizing agent emphasize the fact that "safeguards must be utilized to insure the absolute sterility of surgical supplies."

The appearance of modern sterilizers inculcates trust in their performance and satisfactory performance is conceded even though there is no objective assurance that the sterilizers have been operated properly. The enforcement of a theoretically safe sterilizing schedule may appear to eliminate faulty sterilization, yet neglect of proper inspection, cleansing or maintenance of the sterilizers may have impaired their efficiency so that sterilizing conditions are not actually attained. The hospital staff thinks of sterilizers as plant equipment, while the maintenance department considers them surgical apparatus, with the result that sterilizers are widely recognized (10) as being the most neglected of all hospital equipment.

The rapidity of its action and its wide applicability have established steam as the chief agent for the absolute sterilization of most surgical supplies. The fact that steam must be subjected to pressure to obtain temperatures destructive to bacterial life has made steam sterilization seem mysterious and its control difficult. The sterilizing efficacy of steam depends upon two factors—the temperature of the saturated water vapor in contact with the least accessible spore in the depths of the unsterile material, and the duration of the exposure to the hot vapor.

Steam penetrates and heats porous materials in the sterilizer because 81 per cent of its energy is in the form of latent heat. When steam is chilled it condenses and the latent energy of condensation is dissipated by heating the environs. Thus when

steam strikes the outer layer of a relatively cold bundle of fabric, condensation occurs with consequent heating of the bundle. This exchange of heat continues, layer by layer, until the entire bundle is heated to the temperature of the surrounding steam and contains moisture equivalent to the quantity of heat liberated by the condensed steam. The penetration of the bundle is accomplished principally by the liberation of heat from steam carried into its depths by convection, not by the conduction of heat into its center.

Autoclaves and dressing sterilizers are merely steam pressure chambers arranged to provide ready access to their interiors. Each time the door of such a chamber is shut, air is trapped in a closed space. When steam under pressure is admitted to the space, the air is displaced since it does not mix immediately with the lighter, hotter steam which tends to stratify. When the gases ultimately become homogeneous through diffusion each exerts its own partial pressure and the temperature of the mixture is lower than that characteristic of steam under the pressure indicated by the gauge (Fig. 1) and its heating efficiency is markedly decreased (Fig. 2). If pressure were destructive to bacterial life, suitable conditions for sterilization would exist. However, pressure is but a means of raising the temperature of the steam sufficiently to coagulate bacterial proteins readily. The trapped air hinders sterilization because it prevents the development of the temperature characteristic of saturated steam under 15 pounds gauge pressure.

Before steam is admitted to a closed autoclave the air entrapped in the chamber is at atmospheric pressure and is heavier than the steam which is released into the chamber. Hence the air gravitates to the bottom as the lighter, hotter steam enters. If the air can escape, steam quickly displaces most of the air; the pressure built up in the chamber is that exerted by the steam alone, and conditions of temperature and moisture are suitable for the rapid destruction of all bacterial life.

Modern autoclaves and dressing sterilizers are equipped with automatic valves which permit the air to escape from the bottom of the chamber as the steam displaces it. Fouling of the air ejector

²¹A pressure of 3,000 atmospheres is not sufficient to kill *B. anthracis*, *Escherichia coli*, *Mycobacterium tuberculosis*, or *Bacillus subtilis*. At 20 thousand atmospheres pressure killed vegetative bacteria (4).

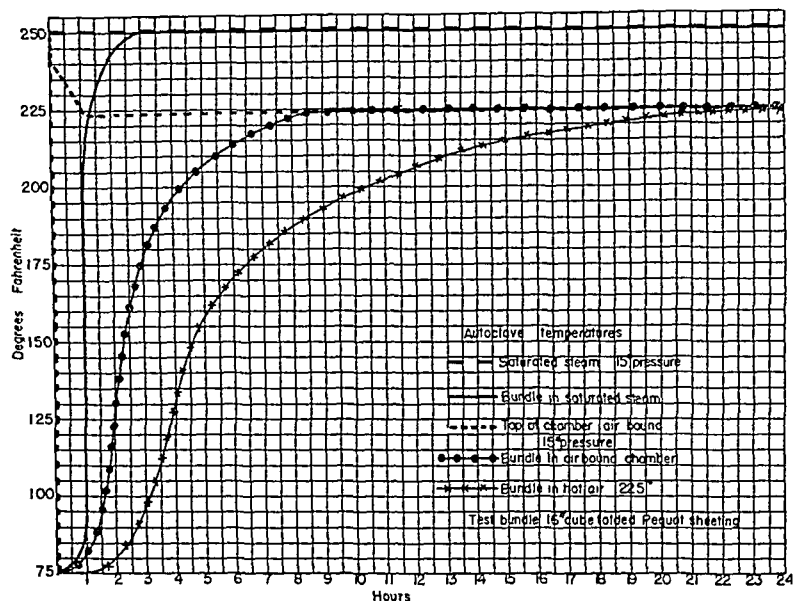


Fig 1 Temperature curves illustrating the time required for penetration of a 16 inch cube of Pequot sheeting under various conditions. The efficiency of saturated steam as a heating agent contrasts markedly with that of a mixture of air and steam (air bound chamber) or hot air alone. The curves were obtained on a recording potentiometer (Leeds and Northrup micromax)

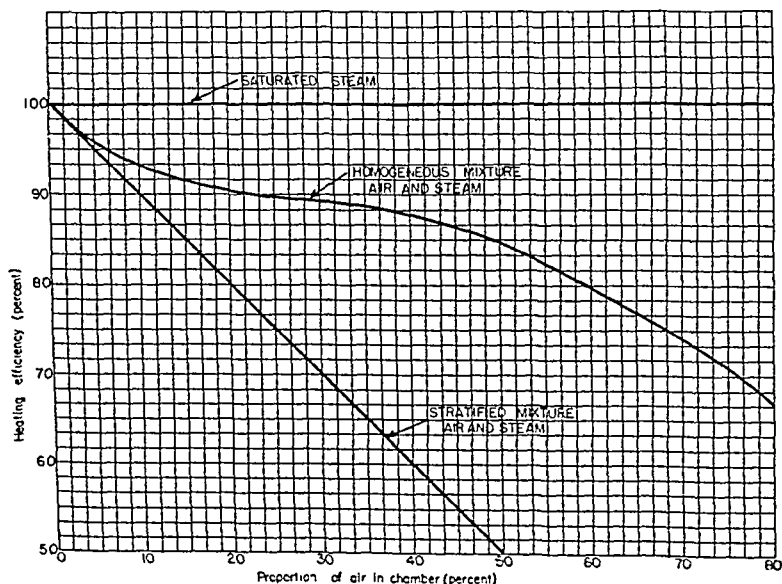


Fig 2 The effect of air in the steam chamber on heating efficiency (Chart courtesy Warren Webster & Company)

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Modern autoclaves and dressing sterilizers are equipped with automatic valves which permit the air to escape from the bottom of the chamber as the steam displaces it. Flooding of the air ejector

¹A pressure of 3.00 atmospheres is not sufficient to kill *Escherichia coli*, *Mycobacterium tuberculosis*, or *Bacillus subtilis*. 5.2 thousand atmospheres pressure is needed to kill *Escherichia coli*.

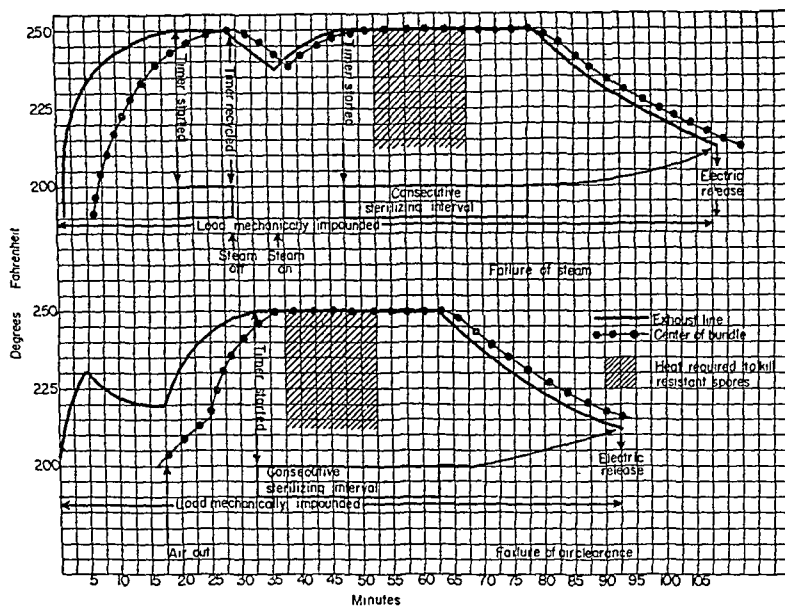


Fig 6 Curves illustrating the action of the control under conditions of faulty sterilization. The load is not released until it has been sterilized.

9, 11, 19) and all of them disregard the human error which arises in their proper use (4, 16) and interpretation. None of the controls force the operator to correlate his interpretation of the detector with the actual operation of the sterilizer or the safe disposition of an unsterile load (1, 18), nor do they prevent unsterile supplies being removed from the poorly functioning or improperly operated sterilizer. To insure absolute sterility, a reliable control must not only reveal failure of the sterilizer itself, but must also prevent the human element from disregarding the warnings indicative of a dangerous fault in the process of sterilization.

A control (Fig 3) has been designed and used in the Peter Bent Brigham Hospital for the past 3 years which *automatically impounds the load until it has been properly sterilized*, thus eliminating all opportunity for human error and insuring the absolute sterility of supplies. This control is fully automatic, indicates the various stages of the sterilizing cycle, and enforces a sequence of operation by impounding the load until the specified sterilizing cycle has been completed. The simplicity of design, rugged construction and housing of the control make it both foolproof and tamper-proof. The device is fail-safe because it acts to release the mechanical lock, which impounds the load, only after the satisfactory com-

pletion of a predetermined cycle. Thus failure of the control, whether mechanical or electrical, cannot result in the release of unsterile supplies. Any deviation from the established minimum of exposure to steam at sterilizing temperature is indicated immediately by appropriate signals; the control thus furnishes a guide for the proper operation of the sterilizer.

The autoclave door is locked by a rolling key clutch mechanism mounted within the handwheel assembly (Fig 4). This clutch wedges the handwheel so that the locking bars cannot be retracted and simultaneously provides the takeup often necessary for sealing the door against leakage of steam as the chamber pressure builds up. After the satisfactory completion of the sterilizing cycle, the rolling keys are released from their wedging position by a magnetic trip.

The sterilizing cycle is checked by a recycling, synchronous electric timer which is controlled by sensitive thermostats located in the exhaust line of the sterilizer.

The sterilizer is operated according to the manufacturer's usual instructions. When the locking bars are forced into position to secure the sterilizer door, a switch is actuated which energizes the control. A red signal indicates that the sterilizer is locked but that the temperature is below that necessary for sterilization. After steam

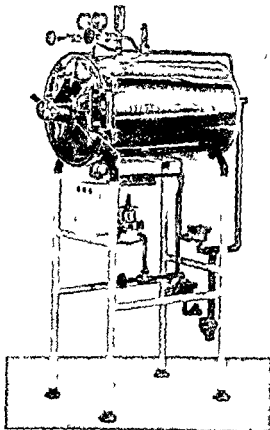


Fig 3

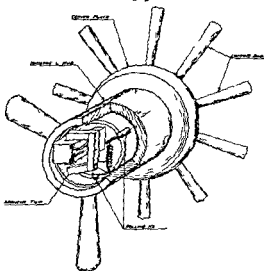


Fig 4

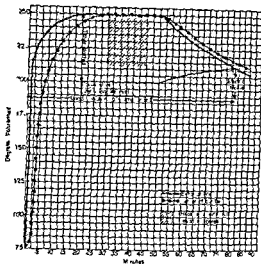


Fig 5

Fig 3 A dressing sterilizer equipped with the control impounds the unsterile load until it has been exposed to saturated steam for a predetermined consecutive interval. Note the control box with its signals, the thermoswitch housing in the exhaust line and the locking mechanism in the hub of the hand wheel.

Fig 4 Cutaway drawing illustrating the rolling key clutch mechanism which wedges the hand wheel so that the sterilizer door cannot be opened until the keys are released by a magnetic trip at the end of a satisfactory sterilizing cycle.

Fig 5 Time temperature relationships which must be met during a sterilizing cycle before the load is released.

o exhaust line with lint, bits of rubber band, or paper tags, pins and other debris is a frequent cause of mechanical failure of sterilizers.

Just as air trapped in the chamber prevents the development of satisfactory conditions for sterilization, air confined within a bundle of surgical supplies hinders the convection of steam into the bundle. If the bundle is loosely packed the air can easily escape as it is displaced by the steam, and penetration with consequent heating of the bundle is rapid and complete. Tightly packed drums and overloaded sterilizers, however, require prolonged exposure to insure slow penetration by conduction.

The problem of controlling steam sterilization involves the determination of when penetration is complete and the enforcement of exposure of the load to an interval of heat destructive to bacterial life.

Numerous devices (2, 3, 6, 7, 8, 9, 13, 14, 15, 17) have been designed to indicate the temperature attained within a steam sterilizer or its load. Many sterility detectors have intrinsic faults (5

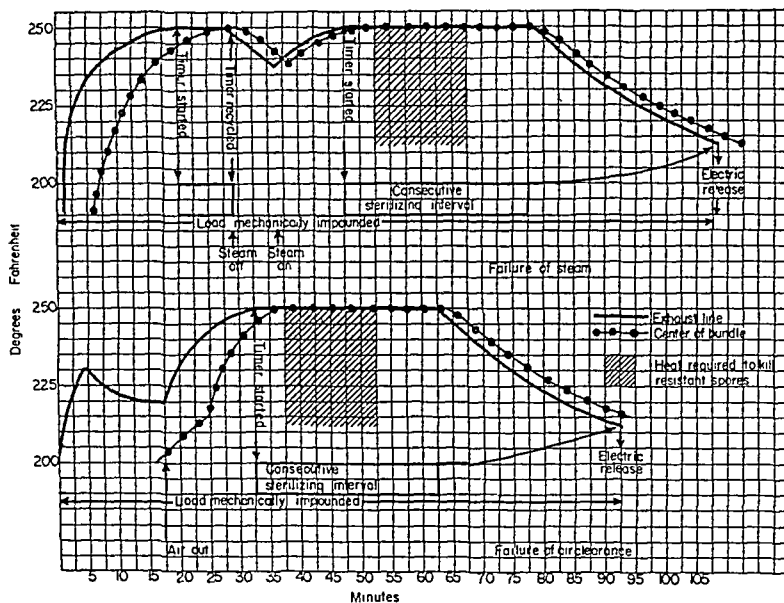


Fig 6 Curves illustrating the action of the control under conditions of faulty sterilization The load is not released until it has been sterilized

9, 11, 19) and all of them disregard the human error which arises in their proper use (4, 16) and interpretation. None of the controls force the operator to correlate his interpretation of the detector with the actual operation of the sterilizer or the safe disposition of an unsterile load (1, 18), nor do they prevent unsterile supplies being removed from the poorly functioning or improperly operated sterilizer. To insure absolute sterility, a reliable control must not only reveal failure of the sterilizer itself, but must also prevent the human element from disregarding the warnings indicative of a dangerous fault in the process of sterilization.

A control (Fig 3) has been designed and used in the Peter Bent Brigham Hospital for the past 3 years which *automatically impounds the load until it has been properly sterilized*, thus eliminating all opportunity for human error and insuring the absolute sterility of supplies. This control is fully automatic, indicates the various stages of the sterilizing cycle, and enforces a sequence of operation by impounding the load until the specified sterilizing cycle has been completed. The simplicity of design, rugged construction and housing of the control make it both foolproof and tamper-proof. The device is fail-safe because it acts to release the mechanical lock, which impounds the load, only after the satisfactory com-

pletion of a predetermined cycle. Thus failure of the control, whether mechanical or electrical, cannot result in the release of unsterile supplies. Any deviation from the established minimum of exposure to steam at sterilizing temperature is indicated immediately by appropriate signals, the control thus furnishes a guide for the proper operation of the sterilizer.

The autoclave door is locked by a rolling key clutch mechanism mounted within the handwheel assembly (Fig 4). This clutch wedges the handwheel so that the locking bars cannot be retracted and simultaneously provides the takeup often necessary for sealing the door against leakage of steam as the chamber pressure builds up. After the satisfactory completion of the sterilizing cycle, the rolling keys are released from their wedging position by a magnetic trip.

The sterilizing cycle is checked by a recycling, synchronous electric timer which is controlled by sensitive thermostats located in the exhaust line of the sterilizer.

The sterilizer is operated according to the manufacturer's usual instructions. When the locking bars are forced into position to secure the sterilizer door, a switch is actuated which energizes the control. A red signal indicates that the sterilizer is locked but that the temperature is below that necessary for sterilization. After steam

has been admitted to the chamber and the temperature of the steam reaches the sterilizing level, a thermoswitch, set for 250 degrees F, starts the timer (Fig 5). A combination of red and green signals now indicates that sterilizing conditions prevail. While the temperature of the steam remains above 250 degrees F, the timer meters a consecutive interval until 30 minutes have elapsed when it trips a switch which changes the signal to green alone indicating that the load is sterile and that the steam may be shut off and the vent valve opened.

After the pressure in the chamber has been relieved and the temperature falls to 210 degrees F, a second thermoswitch closes releasing the clutch. A white signal indicates that the load is sterile and that the hand wheel may be turned to retract the locking bars.

If for any reason the temperature of the steam falls below 250 degrees F, the timer automatically recycles and the entire 30-minute period must be repeated (Fig 6). Thus continuous exposure to saturated steam destructive to bacterial life is assured.

The use of this control provides a reliable check on sterilization in hospitals having dressing sterilizers of adequate size, because overloading of such sterilizers is unlikely.

In hospitals where the sterilizers are too small overloading is almost the rule and further precautions must be taken to measure the penetration of steam into the bundles or drums. This can be done by wrapping a steam proof thermoswitch set for 250 degrees F in the center of the largest bundle or most tightly packed drum. The timer then meters the duration of satisfactory sterilizing conditions in the center of the densest portion of the tightly packed load.

This automatic control provides the surgeon with a reliable method of eliminating faulty sterilization due to failure of the sterilizing equipment and ignorance or negligence on the part of the

attendant. It enforces adherence to a predetermined standard of sterilization sufficient to insure absolute sterility of surgical supplies without waste of steam or damage to fabrics because of excessive exposure to steam.

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EDITORIALS

SURGERY Gynecology and Obstetrics

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OCTOBER, 1938

IMPROVEMENTS IN STERILIZING TECHNIQUE

ALTHOUGH every surgeon will agree that asepsis is the basis of his art, how many thoroughly understand how asepsis is attained? Are surgeons satisfied with the present methods for sterilization? The rapid development of surgery as a therapeutic measure has diminished the surgeon's interest in the preparation of the requisite instruments and supplies, and has focused his attention on the refinement of operative procedure and the exploration of new fields. In most hospitals, sterilization has become the responsibility of the chief nurse in the operating room. Problems which arise are referred either to the surgical staff or to the administration. Usually the nurses receive little expert advice, since neither the surgeon nor the administrator is equipped with sufficient bacteriological or engineering knowledge to be of real assistance. Thus the very foundation of safe surgical therapy lacks that attention

and interest so essential to growth and perfection.

The failure of hospitals to appreciate the value of expert bacteriologists as staff members is partially responsible for such neglect. The appointment of bacteriologists to staff positions equal to that of the physician, surgeon, and pathologist will revive the lagging interest in this basic science. Then only will aseptic technique be studied critically. Meanwhile, epidemics of infected wounds and outbreaks of gas gangrene will occasion infrequent and often casual inspection or tests of the efficiency of the apparatus which makes our art possible.

A cursory survey of the sterilizing practices in hospitals throughout the country reveals striking differences and glaring inconsistencies not only in the technique used, but also in the sterilizing schedule of individual clinics. The principle of aseptic surgery—the reduction of the number of bacteria introduced into a surgical wound to a minimum—is so clear cut that such chaos leads one to suspect inefficiency and faulty sterilization. The concept of asepsis should permit the establishment of a standard of sterilization which would insure absolute sterility of all instruments and supplies used in the operative field. Expediency has forced surgeons to sanction questionable technique, because practical methods for absolute sterilization have not been available.

The emergency sterilization of instruments urgently needed during the course of an operative procedure causes many breaks in asepsis, because the accepted methods for "quick sterilization" are as faulty as they are quick. Sterile instruments can be provided in 3 minutes by using a rapid, high temperature auto-

clave constructed especially for the purpose.¹ Less efficient, unsafe methods have no place in the modern operating room.

The problem of cleansing and sterilizing instruments contaminated with virulent organisms and spores presents itself as frequently as the surgeon deals with sepsis or performs an intestinal operation. Instruments soiled with blood, pus, feces, or grease can be cleansed, sterilized, and dried rapidly and efficiently under superheated water in a new sterilizer¹, designed to remove the oils and protein residues during sterilization. This sterilizer can also be used to sterilize instruments before operation, thus assuring the surgeon of instruments free of spores.

The sterility of surgical dressings is often conceded merely because they have been through a pressure sterilizer. Various sterility detectors have been devised to assure the surgeon sterile supplies, but such detectors have proved inadequate. A new control² which impounds dressings in the sterilizer until they have been exposed to saturated steam for a sufficient interval to destroy all bacterial life, can be used to modernize existing dressing sterilizers.

The improvements in mechanical appliances, outlined in the papers referred to, constitute advances in aseptic surgery of vital importance. The apparatus described has been evolved after careful study, its design is simple and sturdy, and its performance fulfills bacteriological requirements.

The small high temperature autoclave is essential in the operating room, if the surgeon and patient are to be spared unnecessary delay while waiting for the sterilization of an instrument indispensable for the completion of the operation. If rapid sterilization such as that provided by this autoclave is not avail-

able, then instruments are ordinarily inadequately sterilized. The use of superheated water for the sterilization of instruments, soiled with pus and feces, provides for safe terminal disinfection of potentially dangerous instruments.

Infection with spore bearing anaerobes constitutes one of the unpredictable hazards of surgery. If spores are protected by a surrounding layer of oil or grease in the locks of hemostats, sterilization by boiling is impossible and the chance of cross infection is enhanced. Thus, instruments from septic fields and in testinal cases should be cleaned and sterilized under conditions which prevent the dissemination of spores throughout the operating suite.

The new control for steam sterilization is an important advance, which insures sterile supplies by eliminating all opportunity for error due to mechanical failure or human negligence. Experience has shown it to be foolproof and reliable. Prolonged interest in the problem of sterilizing supplies and a realization of the many chances for error lead me to recommend immediate, widespread adoption of the new control.

Such advances in sterilizing technique, the emergency instrument sterilizer, the instrument washer and sterilizer, and the dressing sterilizer control, permit the establishment of a standard of sterilization heretofore but a theoretical attainment—the absolute sterility of all instruments and supplies reaching the operative field.

ELLIOTT C. CUTLER

CANCER OF THE BREAST IN THE NEGRO

THE title is really a misnomer as we are not dealing with a pure race. It is generally agreed that cancer is rarely found in the pure native races which

¹W. H. C. W. Technique of the use of a d. absolute sterilization
not used in S. 2. Gynec. & Obst. 1918 57 244 245
²Walter C. W. A reliable control for steam sterilization S. 15 Gynec
& Obst. 1925 67 310-320.

histological findings indicated the association of so called "cystic mastitis," with the cancer cases

Cancer of the breast reaches its highest incidence in the decade 40 to 50, whereas in the white race, the maximum incidence is between 50 and 60

Within a period of 1 to 4 years following operation for cancer of the breast, the known dead probably reaches the distressing figure of 75 per cent. This may be accounted for by the fact that cancer has been seen, as a rule, late in its course. Investigation of records indicates that adequate care is not always given to the study of the case before operation is resorted to. This does not apply only to cancer of the breast nor does it apply only to surgery in the negro race. It is equally true for all. The challenge to the profession is to educate themselves and to give adequate time to the study of each problem before unwise and unnecessary operations are performed.

After all, the differences between ability and usefulness of the surgeon lie not in the difference in knowledge but in the desire and willingness to give to each patient what is really needed.

Methods of treatment vary. The surgeon should use that form of treatment which his judgment, knowledge of the literature, experience, and ability fit him best to carry out.

Some advise irradiation, x ray or radium, either packs or interstitial implantation. It would seem justifiable to state that irradiation before operation is not indicated in any group of patients who present themselves at a late stage of the operable period. Valuable time is lost while waiting to complete the necessary period after irradiation. During this time, the radical operability of the patient may pass.

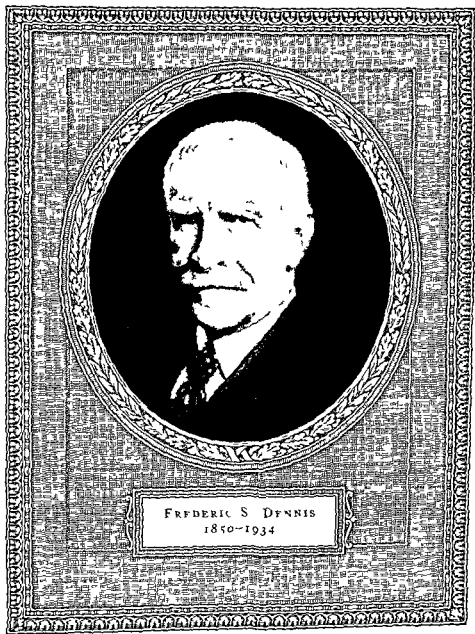
We have no positive proof that cancer of the breast is curable in a high percentage of cases by interstitial irradiation. The best available results are those of Mr. Geoffrey Keynes and his statements indicate that 50 per cent have evidence of active cancer cells in biopsies taken 6 months after interstitial irradiation.

Radical surgery when indicated offers the best opportunity for cure.

In order that better results may be obtained a graduate educational program for the profession is essential. When the profession is more cancer conscious and particularly, when they realize that cancer of the breast is not a rare condition among the negro population, they will examine their patients more adequately and they will also attempt to educate them.

Public education cannot adequately substitute for professional efficiency.

ISIDORE CORN



FREDERIC S. DENNIS
1850-1934

MASTER SURGEONS OF AMERICA

FREDERIC S. DENNIS

AT the close of the eighty-fourth year of his life, Frederic S. Dennis, of New York City, died at his home March 8, 1934

To those of us who go back to the nineties and the earlier years of this century, Dr. Dennis was known as one of the leaders of the new thought in surgery which had been brought about by the work of Pasteur and Lister. He was not only an able surgeon, but his personal qualities were such as to win the warm friendship of all with whom he came in contact. His chief work in those earlier years, when I first knew him, was done at the Bellevue Hospital of New York, where his brilliant lectures and his skillful methods of operating won for him general admiration and respect.

Pasteur, a Frenchman, did more for the human race than any other man who ever lived, but French surgeons, while they accomplished much in the middle of the last century for fine anatomical dissections, had not fully accepted the relationship to disease as brought out by Pasteur's discoveries, just as the medical profession of Great Britain failed to grasp what Lister's discoveries meant to medicine and to surgery.

American surgeons of the earlier period, brilliant and well trained though they were in anatomy through the Scottish masters and in the gross pathology of the "dead-house" of the English tradition, were not as yet so versed in the "pathology of the living" as men who had been educated in Europe by the followers of Pasteur and Lister.

As I look back on this period in American surgery, I recall brilliant men whose names are familiar to the older members of the profession in Boston, Richardson, Cheever, the Cabots, the Warrens, Watson, and many others, in New York, Dennis, Weir, McBurney, Bull, and others. In Philadelphia was that great triumvirate, the Grosses, father and son, and Agnew. And so one could go over the country, recounting great surgeons, trained anatomists, dead-house pathologists, but the majority of them at that time lacking in that essential thing which was brought in by Pasteur and Lister.

American students realized that what we had in America was the art of surgery based on the science of anatomy and dead-house pathology, but that we lacked the "living pathology" which was the foundation on which surgery must achieve its purpose.

In 1876 Dr. Dennis, in company with Dr. William H. Welch, his lifelong friend, went abroad, largely to study with Lister and gain an understanding of

those principles of surgical pathology, asepsis and antiseptics which the germ theory had brought forth. On his return, Dr. Dennis became one of the foremost teachers of the new era.

It would be idle for me to write of the many contributions Dr. Dennis made to surgical progress, by example illustrating the difference between the surgeon and the operator. Surgery is more a matter of mental grasp than it is of hand-craftsmanship. I think all of us who have worked years in the profession understand that many very skillful operators are not good surgeons.

When one scans the years in which Dr. Dennis devoted himself not only to active surgical practice but to teaching surgery by the spoken word and by the written word, one is impressed by the wealth of his learned contributions to the literature. Among them was one of the greatest texts on surgery ever written, his *Systems of Surgery*, brought out in four volumes in 1893 and 1896.

Dr. Dennis for some years before his death reviewed his medical writings, with the idea of putting into book form certain selected surgical papers from this most valuable material which would represent the history of a surgical epoch. This work he completed.

I am grateful for this opportunity to express the appreciation of American surgeons for aid given by the highly educated wise men of our profession, among whom none has been more esteemed than Frederic S. Dennis. He is held in honored memory.

W. J. MAYO

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

IN THE third edition of the popular work, *X-rays and Radium in the Treatment of Diseases of the Skin*¹ by MacKee are incorporated so many changes that it is really a new book. When the first edition was published almost 20 years ago, it was a pioneer effort on the part of the author but one that was most welcome to all dermatologists and all practitioners engaged in the treatment of skin diseases.

In the last few years there has been a remarkable increase in our knowledge of physics, biochemistry, physiology, histopathology, and the technique of administering x-rays and radium. Because of this the author has assigned the writing of many of these chapters to collaborators who are experts in their respective fields.

There are 42 chapters and among them are new chapters on physics, biology, histopathology, apparatus, and x-ray technique. The chapters on psoriasis, lichen planus, the hematopoietic diseases, fungus diseases, and pyodermas as well as the chapter dealing with miscellaneous diseases have all been revised and rewritten.

The author believes that there is an increasing indisposition on the part of dermatologists to employ x-rays only when necessary, and with discriminating judgment. In the clinical portions of the book devoted to the treatment of skin diseases, his own conservatism is reflected. These chapters should prove of inestimable value to the younger men.

The text is clear, concise and authoritative. There is an extensive bibliography at the end of each chapter. The paper is of excellent quality and the book is printed in large legible type. The illustrations are excellent.

The book embodies the latest established principles of roentgen therapy and their practical application and is most earnestly recommended to all practitioners interested in roentgen and radium therapy. It is the foremost authority in its field.

EDWARD A. OLIVER

THE contributors to *Clinical Roentgen Therapy*² were: Chavany, Desjardins, Eller, Golden, Henderson, Holfelder, Hubeny, Juengling, Langer, MacKee, Martin, Meyer, Pohle, Richards, Sevringhaus, Waters, and Zimmern. Dedication honors the memory of the late Preston M. Hickey.

Preliminary chapters concern diseases of the blood and blood-forming organs. Some 20 pages are given

over to the treatment of leucemia. There are chapters on diseases of the circulatory system, the respiratory system and the breast, some of the less frequently recognized indications in digestive disorders, more than 150 pages concerning radiation therapy in diseases of the female genital organs, and an additional 55 pages discussing similar diseases in the male. Further chapters cover the nervous system and the eye and ear. Chapter IX by Juengling is a notable contribution of over 100 pages on diseases of muscles, tendons, bones and joints, including fractures. Chapter X on the glands of internal secretion is a very interesting summary of the work in which Langer did much of the pioneering. Eller discusses diseases of the skin and MacKee reactions and injuries from the x-ray. An appendix is devoted to some of the medicolegal aspects of radiation therapy.

The book is authoritative, comprehensive, and gives us a very fair and reasonable presentation of the entire subject of radiation therapy. Here and there one might differ from the authors in minor details, but on the whole the book is a very dependable guide in the application of roentgen rays to the treatment of disease.

JAMES T. CASE

THE appearance of the first edition of Kronfeld's *Introduction to Ophthalmology*³ is most welcome. In the preface, the author states that "he has endeavored to formulate the principles underlying that portion of ophthalmology which is a necessary part of basic medical education. The presentation of these principles will, it is hoped, prove useful as a supplement to the short and chiefly practical courses to which the teaching of ophthalmology has had to be reduced in the curriculum of many medical schools. The material presented pertains principally to the pathogenesis of disease. The details of diagnosis, of methods of examination, and of treatment have been omitted. Individual diseases are discussed in this book to illustrate pathogenetic principles. A large number of common diseases have been omitted altogether from the text because they are unimportant for the exposition of ophthalmological principles. Of these diseases the reader will find short descriptions in the dictionary which is combined with the index of this book."

The text is by no means elementary. In this respect it cannot be intended for undergraduate students alone, it can, however, be recommended highly for internes and residents specializing in

INTRODUCTION TO OPHTHALMOLOGY. By Peter C. Kronfeld, M.D. Springfield, Ill., and Baltimore, Md. Charles C. Thomas, 1937.

¹X-RAYS AND RADIUM IN THE TREATMENT OF DISEASES OF THE SKIN. By George M. MacKee, M.D. 3d rev. ed. Philadelphia: Lea & Febiger, 1938.

²CLINICAL ROENTGEN THERAPY. Edited by Ernst A. Pohle, M.D., Ph.D., F.A.C.R. Foreword by George W. Holmes, M.D. Philadelphia: Lea & Febiger, 1938.

ophthalmology and for practicing oculists. The current thought in ophthalmology is presented clearly and concisely, especially in the chapters on vascular diseases of the eye and in chapter on visual pathway. It is obvious that the author's extensive teaching experience is exemplified in these chapters.

The subject matter is presented with simplicity and clarity in those problems in which the young oculist can be most easily confused if he resorts merely to a perusal of the current literature.

The binding, paper and print are admirable and an excellent index and ophthalmological dictionary close the work. The illustrations, although limited as to number, are excellent and really illustrative. This book is another example of the excellent texts on ophthalmology that are being produced in this country which are freeing the American ophthalmologists from the nearly century old bonds of Teutonic domination of the subject.

HARRY S. GRADLE

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

DER ZYKLUS DER FRÜH REFORM DES EHELEBENS. By Dr. Jules Samuels. The Hague: G. Naef, 1938.

FRACTURES OF THE JAW. By Robert H. Ivy, M.D., D.D.S., F.A.C.S., and Lawrence Curtis, A.B., M.D., D.D.S., F.A.C.S., 2d rev. ed. Philadelphia: Lea & Febiger, 1938.

THE PRINCIPLES AND PRACTICE OF MEDICINE. DESIGNED FOR THE USE OF PRACTITIONERS AND STUDENTS OF MEDICINE. Originally written by the late Sir William Osler, Bart., M.D., F.R.C.P., F.R.S. Revised by Henry A. Christian, M.D., LL.D., S.D., F.P.C.I. The 9th, 10th, 11th and 12th eds. revised by Thomas McCrae, M.D., F.R.C.P. 13th ed. New York and London: D. Appleton Century Co. Inc., 1938.

ANUS RECTUM SIGMOID COLON, DIAGNOSIS AND TREATMENT. By Harry Elliott Bacon, B.S., M.D., F.A.C.S., F.A.P.S. Introduction by W. Wayne Babcock, A.M., M.D., LL.D., F.A.C.S. Foreword by J. P. Lockhart.

Mummery, M.A., M.B., B.C. (Cantab.), F.R.C.S. (Eng.) Philadelphia: Montreal and London: J. B. Lippincott Co., 1938.

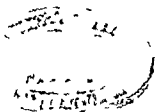
LIFE AND LETTERS OF FIELDING H. GARRISON. By Solomon R. Nagin, M.D. With an introduction by Irvin James J. Walsh. Boston, Mass.: The Medico-Historical Press, 1938.

APUNTES DE TÉCNICA OPERATORIA (Temas de práctica diaria). Primer cuaderno pre y post-operatorio. By Dr. Juan G. Moreno. Buenos Aires: Librería y Editorial El Ateneo, 1938.

THE PRINCIPLES AND PRACTICE OF MEDICAL NURSING. By Victor Knapp, M.D. New York: G. P. Putnam's Sons, 1938.

APPLIED ANATOMY, FUNCTIONAL AND TOPOGRAPHICAL. By Robert H. Miller, M.D. Philadelphia: Lea & Febiger, 1938.

EXPERIENCE IN THE MANAGEMENT OF FRACTURES AND DISLOCATIONS (Based on an Analysis of 4300 Cases). By The Staff of the Fracture Service, Massachusetts General Hospital, Boston, under the general editorship of Philip D. Wilson, M.D. Philadelphia: London and Montreal: J. B. Lippincott Co., 1938.



CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

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HOWARD C NAFFZIGER, San Francisco, *President-Elect*

New York Committee on Arrangements
HENRY W. CAVE, *Chairman*, HOWARD A PATTERSON, *Secretary*

Brooklyn-Long Island Committee on Arrangements
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PROGRAM FOR THE 1938 CLINICAL CONGRESS

THE complete program for the twenty-eighth annual Clinical Congress of the American College of Surgeons, to be held in New York and Brooklyn, October 17 to 21, appears in the following pages

Under the leadership of strong and representative committees, the surgeons of greater New York have prepared a program of operative clinics and demonstrations that will provide a complete showing of their clinical activities in all departments of surgery. The Committee on Arrangements has the hearty co-operation of the clinicians at the five medical schools and more than sixty hospitals that will participate in the clinical program. Clinics will be held on the afternoon of Monday, October 17, and on the mornings and afternoons of each of the following four days. Wednesday, October 19, has been designated as Brooklyn-Long Island Day, and the clinical program on that day will be presented in Brooklyn hospitals.

It will be noted that the program provides an ample and well arranged schedule of operative clinics, at which the technique of a wide variety of surgical procedures will be demonstrated in the operating rooms, and in addition, the committees have arranged a series of non-operative clinics in many of the large hospitals and medical schools for the presentation of the work being done in many special fields. The programs are so correlated that the visiting surgeon may devote his time continuously, if he so desires, to clinics dealing with the special subject in which he is most interested. For example, clinics in fractures, neurosurgery, thoracic surgery, plastic surgery,

COMMITTEE ON ARRANGEMENTS

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CHESTER L DAVIDSON	FEDOR L SINGER
AUGUSTUS HARRIS	ROBERT A WILSON

cancer, etc., will be available each forenoon and afternoon during the Congress.

The actual program of the Congress will be published from day to day in the *Daily Clinical Bulletin*. Each afternoon the complete detailed clinical program for the following day will be posted in the form of bulletins at headquarters. The same material will be published in printed form for distribution the following morning.

The annual meeting of the governors and fellows of the College will be held in the ballroom of the Waldorf-Astoria on Thursday afternoon at 1.30 o'clock. Reports on activities of the College

CLINICAL CONGRESS PROGRAM IN BRIEF

All sessions at the Waldorf Astoria except as noted

Monday, October 17

- 10 00 Hospital Conference—Ballroom
- 2 00 Clinics in New York Hospitals
- 2 00 Hospital Conference—Sert Room
- 2 00 Surgical Film Exhibition—Empire Room
- 3 00 Meeting of Initiates—Ballroom
- 4 00 Reception to Fellows and Initiates—Ballroom
- 8 00 Residential Meeting and Convocation—Ballroom

Tuesday, October 18

- 9 00 Clinics in New York Hospitals
- 9 30 Hospital Conference—Sert Rooms
- 9 30 State and Provincial Judiciary Committees—Empire Room
- 10 00 State and Provincial Credentials Committees—Empire Room
- 11 00 State and Provincial Executive Committees—Empire Room
- 12 00 Clinical Conferences—Jansen Suite Blue Room Assembly and Carpenter Suites
- 2 00 Clinics in New York Hospitals
- 2 00 Cancer Symposium—Ballroom
- 2 00 Hospital Conference—Sert Room
- 2 00 Surgical Film Exhibition—Empire Room
- 8 00 Scientific Session General Surgery—Ballroom
- 8 00 Scientific Session Ophthalmology—Sert Room
- 8 00 Scientific Session Otorhinolaryngology—Empire Room
- 8 00 Hospital Conference—Jansen Suite

Wednesday, October 19—Brooklyn Day

- 9 00 Clinics in Brooklyn Hospitals
- 9 30 Hospital Conference—Sert Room
- 10 00 Surgical Film Exhibition—Ballroom

- 12 00 Clinical Conferences—Jansen and Assembly Suites Blue Room Empire Room
- 2 00 Scientific Session General Surgery—Ballroom
- 2 00 Hospital Demonstrations—New York Hospitals
- 2 00 Clinics in Brooklyn Hospitals
- 8 00 Scientific Session General Surgery—Ballroom
- 8 00 Surgical Film Exhibition (Ophthalmology and Otolaryngology)—Empire Room

Thursday, October 20

- 9 00 Clinics in New York Hospitals
- 9 30 Hospital Conference—Sert Room
- 10 00 Surgical Film Exhibition—Empire Room
- 1 30 Annual Meeting—Ballroom
- 2 00 Clinics in New York Hospitals
- 2 00 Hospital Conferences—Sert Room and LePerroquet Suite
- 3 00 Symposium on Industrial Medicine and Traumatic Surgery—Ballroom
- 3 00 Surgical Film Exhibition—Empire Room
- 8 00 Scientific Session General Surgery—Ballroom
- 8 00 Scientific Session Otorhinolaryngology—Empire Room
- 8 00 Scientific Session Ophthalmology—Sert Room

Friday, October 21

- 9 00 Clinics in New York Hospitals
- 10 00 Surgical Film Exhibition—Empire Room
- 12 00 Clinical Conferences—Jansen LePerroquet and Assembly Suites Blue Room
- 2 00 Clinics in New York Hospitals
- 2 00 Fracture Symposium—Ballroom
- 2 00 Symposium on Obstetrics and Gynecology—Sert Room
- 2 00 Urological Symposium—LePerroquet Suite
- 2 00 Surgical Film Exhibition—Empire Room
- 8 00 Community Health Meeting—Ballroom

will be presented by the officers and chairmen of standing committees to be followed by the election of officers.

The attention of fellows is called to the meetings of three committees to be held in the Empire Room on Tuesday forenoon as follows: State and Provincial Judiciary Committees at 9 30; State and Provincial Credentials Committees at 10; State and Provincial Executive Committees at 11.

The showing of surgical motion picture films which so faithfully depict clinical features of major interest to most surgeons, will be continued at this year's Congress. It is planned to present an enlarged program of both sound and silent pictures at daily exhibitions at headquarters.

PRESIDENTIAL MEETING AND CONVOCATION

The combined presidential meeting and convocation will be held in the ballroom of the Waldorf Astoria on Monday evening at 8 o'clock opening with a processional of the officers, regents, and honorary guests. Following the invocation Dr. Henry W. Cave, Chairman of the Committee on Arrangements, will deliver the address of welcome.

and the foreign guests will be introduced. Dr. Frederic A. Besley, of Waukegan, the retiring president of the College, will deliver the presidential address after which the new officers will be inaugurated and fellowships conferred upon the initiates. Honorary fellowships will then be conferred and the medical records honor list and prize award announced.

The concluding feature of the program will be the annual oration on surgery, to be delivered by Dr. Walter W. Chipman, of Montreal, a former president of the College, whose subject will be "Our College Mandate—A Tribute to Allen B. Kanavel."

ASSEMBLY OF INITIATES

Following the plan adopted last year, all of the convocation ceremonies, except the formal conferring of fellowships, will be included in a session on Monday afternoon preceding the combined convocation and presidential meeting in the evening. The afternoon assembly will be held in the ballroom of the Waldorf Astoria and will be attended by the initiates and fellows.

wearing the fellowship gown. Officials of the College will interpret the program of the College and the president-elect will extend official greetings. The initiates will recite the fellowship pledge and sign the fellowship roll, after which a reception will be held by the officers and regents for the Fellows and initiates and members of their families.

SCIENTIFIC SESSIONS

In the general scientific sessions scheduled for Tuesday, Wednesday, and Thursday evenings, the aim in many of the subjects to be covered is to correlate the medical and the surgical phases of treatment of various specific pathological conditions. Several different subjects will be presented each evening. The Brooklyn Chapter of the College has co-operated in arranging the Wednesday evening program.

Sessions on ophthalmology and on otorhinolaryngology will be held on Tuesday and Thursday evenings. A feature of the Tuesday evening sessions, in addition to the scientific papers presented, will be discussions of graduate training for these specialties.

The afternoon sessions will include symposia on the subjects of cancer, industrial medicine and traumatic surgery, and fractures, scheduled for Tuesday, Thursday, and Friday respectively. On Friday afternoon there will be two additional symposia—one on obstetrics and gynecology, and the other on urologic infections. The session to be held on Wednesday afternoon will be devoted to a symposium on the subject of "Surgical Procedures on the Handicapped Patient," in which anesthetists and internists as well as surgeons will participate.

The midday round table conferences on Tuesday, Wednesday, and Friday, are a new feature of the Congress. There will be twelve in all, each devoted to a specific subject so restricted as to be more suitably covered in this way than in the general session. The leader will present the subject and selected authorities will discuss the various phases briefly. Then an open forum, directed by the leader and collaborators, will be devoted to the presentation of ideas informally. Since the rooms in which these discussions will be held are not large, registration will be limited by their capacity and should therefore be made as early as possible.

All of the programs, details of which are presented in the following pages, have been arranged by the program committee to include material of the widest possible interest, with consideration of the viewpoints of the specialist as well as of the general surgeon.

BROOKLYN-LONG ISLAND DAY

A revised program for Brooklyn-Long Island Day (Wednesday) has been effected which promises to serve the best interests of the visiting fellows. The program will be concentrated in eleven institutions located in mid-Brooklyn which afford the physical accommodations required. The institutions selected are of such size as to provide comfortably for all of the visiting fellows, and their geographic location is such that the distance from headquarters is but a matter of minutes.

Through the courtesy of the Brooklyn and Long Island chapter, free transportation from the Waldorf-Astoria to the Brooklyn institutions via taxicab has been arranged, effective between the hours of 8 and 10 a m. This will obviate the necessity of depending upon the usual transportation and will assure prompt arrival of the fellows at their desired destinations.

At each institution a morning program of both operative and dry clinics will be presented from 9 a m. to 12 30 p m., followed by a luncheon to the visitors. The afternoon has been set aside for the presentation of symposia covering all of the specialties and arrangements have been made for adequate transportation from one hospital to another at midday, so as to facilitate attendance at any symposium selected. Each symposium will be presided over by a moderator, whose duty it will be to keep the papers within the time limit, so that the programs will conclude at 4 p m. The evening session will be held in the ballroom of the Waldorf-Astoria at 8 o'clock.

GRADUATE TRAINING FOR SURGERY

The American College of Surgeons was founded on the determination to raise the standards of surgery. That its concept of those standards has developed with the progress of the art and science of surgery is proved by the insistence of the College upon systematic supervision of the young surgeon's first few years of surgical practice. The College program for increasing the opportunities for graduate training in general surgery and the surgical specialties, adopted after careful study of present plans and the needs of the immediate future, has reached the stage of practical application. The symposium in which this subject will be covered should claim the attendance of every fellow and of every hospital executive, because it will picture the progress and the prospects of one of the most important movements to stimulate better surgery.

This symposium on graduate training for surgery and the surgical specialties will be held at the opening session of the Hospital Conference in the

Waldorf Astoria ballroom on Monday, at 10 a m. The committee will present its second annual report through its chairman Dr Dallas B Phemister of Chicago. This will be based on personal surveys by representatives of the College and the data contributed by more than three hundred hospitals which are or could readily be organized and equipped to offer acceptable graduate training.

Following presentation of the report, a member of the survey staff will offer practical suggestions for organizing and executing plans for graduate training. Then, in a panel discussion, will be given the ideas on content of courses for adequate training from the viewpoints of the general surgeon, the obstetrician and gynecologist, the neurosurgeon, the urologist, and the orthopedist. This will be supplemented by general discussion.

The plan of the College for graduate training, it should be repeated, is no longer in the formative stage—it is ready for practical application and has already been adopted by many institutions. To be conversant with its full implications from an educational and practical viewpoint is to understand one of the most potent influences operating to affect the future of surgery, since necessarily scientific progress will be promoted by raising training standards. Every approved hospital large enough to offer the diversification of practice and the facilities for graduate training, either directly or through co-operation with a medical school should become familiar with the requirements because it is desirable that guided instruction in surgery shall become a universal practice in order to protect the patient from the inexperienced surgeon. This symposium should be recognized as one not to be omitted from the schedule of any one wishing to keep informed on current developments in surgery.

HOSPITAL CONFERENCE

Official announcement of the 1938 list of approved hospitals will be made following the address of the president of the College at the opening session of the twenty first annual hospital standardization conference in the ballroom of the Waldorf Astoria on Monday morning, at 10 o'clock. Thereafter a report of the survey on graduate training for surgery (general surgery and the surgical specialties) will be presented and the remainder of that session of the hospital conference will be devoted to a discussion of what constitutes adequate training in general surgery and the surgical specialties and how this program can be put into effect in selected hospitals.

The important subject of co-operation between voluntary and governmental or tax supported hospitals will be discussed by the first speaker at

the Monday afternoon session, to be held in the Sert Room of the hotel. This will be followed by two papers in which important nursing problems will be considered. Additional subjects will be personnel management, the organization and management of volunteer service in hospitals and in conclusion a new subject which is now being accorded a scientific cognomen when used in the care of the patient—bibliotherapy.

Physical factors affecting patients and personnel will be the chief topic of discussion at the Tuesday morning session at 9:30 in the Sert Room. Light, noise, air conditioning, provisions for isolation of certain patients, and preparedness for emergencies will be considered. At this session will also be given a paper on sources and control of infections. The final feature will be a talk illustrated by motion pictures on blood bank service.

"The Care of the Mother and the Newborn in the General Hospital" will be the subject of the panel discussion scheduled for Tuesday afternoon, beginning at 2 o'clock. Dr Malcolm T MacEachern, associate director of the College, will present the minimum requirements of the College for an obstetrical department in a general hospital followed by discussion from various viewpoints and concluding with a presentation of the New York Brooklyn plan of evaluation of maternal fatalities as conducted by the Committee of the New York and King County Medical Societies.

On Wednesday morning at an important joint conference with the Association of Record Librarians of North America, the papers and discussions will embrace problems of procuring, compiling and using medical records. This association is working to solve many of the practical problems involved in keeping adequate medical records in hospitals.

Wednesday afternoon the scene will shift to local hospitals where demonstrations of administrative and technical procedures of general and specialized interest to hospital executives and personnel will be conducted.

Thursday morning, in the Sert Room a symposium on the all important subject of the training of hospital executives will be presented with discussion from a number of viewpoints of the need for such training. At the closing session of the conference on Thursday afternoon an administrative panel round table conference will be conducted by Robert Jolly of Houston, Texas in which a great many questions and problems submitted beforehand or during the session, will be answered and discussed by selected authorities or by the general assembly.

MEETING ON HEALTH CONSERVATION

A community health meeting, as in former years a part of the Clinical Congress, is scheduled for Friday evening in the ballroom of the Waldorf-Astoria. The program, with the general title of "Health Conservation—Our Mutual Contributions," will consist of several short talks, most of them illustrated, on the activities of the College, scientific medicine, hospitals and health—aimed to give authoritative information to the interested layman and to acknowledge the contributions of the public to the advancement of the science of medicine, which have established a mutually helpful relationship between the public and the profession. Dr Howard C Nafziger, president of the College, will preside. The program follows:

The American College of Surgeons—Its Purposes—Its Program George Crile, M D, Cleveland.

Seven Wonders of Medicine (Illustrated). Bowman C Crowell, M D, Chicago

What Is an Approved Hospital? (Illustrated) Malcolm T MacEachern, M D, Chicago

Medical Science and the Public Irvin Abell, M D, Louisville

Man, Research, and Disease Clarence Cook Little, Sc D, Bar Harbor, Maine

Prevention of Disease Frank H Lahey, M D, Boston
The Voluntary Hospital Walter W Chipman, M D, Montreal

HEADQUARTERS—TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Waldorf-Astoria Hotel, on Park Avenue between 49th and 50th Streets, where the grand ballroom and large adjacent foyers, the Astor Gallery, Jade and Basildon Rooms, all on the third floor of the hotel, have been reserved for Congress headquarters—scientific sessions and conferences, and for the scientific and technical exhibits.

The technical exhibition, together with the registration and clinic ticket bureaus, will be located in the East Foyer, Astor Gallery, Jade and Basildon Rooms, all on the third floor of the hotel. The bulletin boards, on which the daily clinical program will be posted each afternoon for the following day, will be placed in these rooms. Leading manufacturers of surgical instruments, x-ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus and supplies of all kinds, pharmaceuticals and publishers of medical books will be represented in this exhibition.

NEW YORK HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Waldorf-Astoria, there are many first-class hotels

within short walking distance of headquarters, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee:

	Minimum Rate with Bath	
	Single	Double
Ambassador, Park Ave at 51st St	\$6 00	\$8 00
Barclay, 111 East 48th St	6 00	10 00
Belmont-Plaza, Lexington Ave at 49th St	3 50	6 00
Biltmore, Madison Ave at 44th St	6 00	8 00
Chatham, Vanderbilt Ave at 48th St	4 00	7 00
Commodore, 42nd St at Lexington Ave	3 50	5 00
Lexington, Lexington Ave at 48th St	3 50	4 50
New Weston, Madison Ave at 50th St	4 00	6 00
Park Lane, 299 Park Ave	6 00	8 00
Ritz-Carlton, Madison Ave at 46th St	7 00	9 00
Roosevelt, Madison Ave at 45th St	5 00	7 00
Shelton, Lexington Ave at 48th St	3 00	4 50
Waldorf-Astoria, Park Ave at 50th St	7 00	10 00

ADVANCE REGISTRATION

The hospitals and medical schools of Greater New York afford accommodation for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be limited to a number that can be comfortably accommodated at the clinics. The limit of attendance will be based upon the result of a survey of the operating rooms and laboratories of the hospitals and medical schools, to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance. A registration fee will be required of surgeons attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the Congress. To each surgeon registering in advance a formal receipt will be issued, which is to be exchanged for a general admission card upon his registration at headquarters during the Congress. This card is not transferable and must be presented in order to secure clinic tickets and admission to scientific sessions.

A resolution adopted by the Board of Regents provides that the registration fee for fellows and endorsed junior candidates shall be \$5 00, that no fee for the 1938 Congress shall be required of initiates (class of 1938), that the fee for non-fellows attending as invited guests of the College shall be \$10 00.

Admission to clinics and demonstrations at the hospitals will be controlled by means of clinic tickets. This plan provides an efficient means for the distribution of the visiting surgeons among the various clinics and assures against overcrowding. The number of tickets issued for any clinic

will be limited to the capacity of the room in which the clinic is given

RAILROAD FARES

No special rates have been authorized by the railroads for the 1938 Clinical Congress in New York and Brooklyn so that certificates will not be required. However, the railroads in the western, northwestern and southwestern states will offer for sale in October round trip tickets to New York, via the Chicago and St. Louis gateways

with a 30-day return limit. In the southern states round trip tickets will also be available.

In the territory east of Chicago and St. Louis, north of the Ohio and Potomac rivers, including the north Atlantic and New England states and the eastern provinces of Canada, regular rates of 3 cents per mile in pullmans and $2\frac{1}{2}$ cents per mile in coaches will be in effect.

Local ticket agents will supply complete information as to rates, routes and stop-over privileges.

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday, 10:00—Ballroom Waldorf Astoria Hotel

FREDERIC A. BESLEY, M.D., Wakefield, Presiding
 American College of Surgeons, presiding
 Address of the President—Twenty-one Years of Hospital Standardization Resulting Benefits to Medical Science
 The 1938 Hospital Standardization Survey—Official Announcement of the List of Approved Hospitals. GEORGE CHILE, M.D., Cleveland, Chairman, Board of Regents, American College of Surgeons.
 Report of Survey—Graduate Training for Surgery and the Surgical Specialties. DALLAS B. PRUEMISTER, M.D., Chicago.
 Organizing and Executing a Plan for Graduate Training for Surgery in a Hospital. HAROLD EARNHEART, M.D., Chicago.
 Panel Discussion—Content of Courses for Adequate Training in General Surgery and the Surgical Specialties from the following viewpoints:
 General Surgery. ALLEN O. WHIPPLE, M.D., New York.
 Obstetrics and Gynecology. JOHN R. FRAYER, M.D., Montreal.
 Neurosurgery. HOWARD C. NATZIGER, M.D., San Francisco.
 Urology. HERMAN L. KRETSCHMER, M.D., Chicago.
 Orthopedics. PHILIP D. WILSON, M.D., New York.
 Discussion. Led by ARTHUR M. WRIGHT, M.D., New York, and DERYL HART, M.D., Durham, N.C.

Monday, 2:00—Sert Room Waldorf Astoria Hotel

ALLAN CRAIG, M.D., Bangor, Maine, presiding
 Co-operation Between Voluntary and Governmental or Tax-Supported Hospitals. S. S. GOLDWATER, M.D., New York.
 Present Trends in Nursing as Affecting Nursing Education and Nursing Service in Hospitals. EFFIE J. TAYLOR, New Haven.
 A Grading Program for Schools of Nurses. REV. A. M. SCHWITALLA, S.J., St. Louis.
 Personnel Management. JOSEPH C. DOANE, M.D., Philadelphia.
 The Organization and Management of Volunteer Service in the Hospital. CHRISTOPHER G. FARVALL, M.D., Rochester, N.Y.
 The Role of Bibliotherapy in the Care of the Patient. GORDON R. KAMMAN, M.D., St. Paul.
 Discussion. Led by OLIVER H. BARTINE, Bridgeport.

Tuesday, 9:30—Sert Room Waldorf Astoria Hotel

FRASER D. MOONLY, M.D., Buffalo, presiding
 Panel Round Table Discussion—Physical and Other Con-

ditions in the Hospital Related to the Care of the Patient and the Working Conditions of the Personnel
 Lighting in the Operating Room. WILLIAM J. ENGEL, M.D., Cleveland.

Air Conditioning in Hospitals. VICTOR A. FRID, Hartford, Conn.

Noise in the Hospital. Its Effect on Patients. Its Control. HARVEY AONE, M.D., Toronto.

Emergency Lighting in Hospitals. CHARLES F. ALER, CAARD, New York.

Provision for Isolation of Infected Patients in General Hospitals. A. J. McRAE, M.D., Hempstead, N.Y.

Preparedness for Emergencies. MIRIAM CURTIS, R.N., Northampton, Mass.

Infections: Sources and Control. CLAUDE W. MCGEE, M.D., New York.

Blood Bank Service (Illustrated by motion picture). KARL A. MEYER, M.D., LEONARD H. WEISSMAN, M.D., and J. LESTER WILKEY, M.D., Chicago.

Tuesday, 10:00—Sert Room Waldorf Astoria Hotel

GEORGE W. KOSMAK, M.D., New York, presiding
 Presentation of the Minimum Requirements of the American College of Surgeons for the Obstetrical Department in a General Hospital. MALCOLM T. MALACHUK, M.D., Chicago.

Panel Discussion—The Care of the Mother and Newborn in the General Hospital.

Discussion from the viewpoints of:

Organization of the Obstetrical Department so as to Provide Administrative and Clinical Efficiency and Control. FRED L. ADAIR, M.D., Chicago.

Provision and Indications for Segregation and Isolation of Obstetrical Patients and Newborn to Prevent Infection. HERMAN W. JOHNSON, M.D., Houston, Texas.

Organization of the Obstetrical Staff with Particular Reference to Qualifications and Grading of Privileges. HARVEY B. MATTHEWS, M.D., Brooklyn.

Indications for Consultations on the Obstetrical Service and Proper Procedure in Securing These. PAUL TITUS, M.D., Pittsburgh.

Analysis of the Clinical Work of the Obstetrical Service with Special Emphasis on Morbidities and Mortalities. JAMES R. MILLER, M.D., Hartford.

Assuring the Mother and Newborn Efficient Nursing Care. JESSIE J. TURNELL, R.N., Pittsburgh.

Proper Training of Interns and Residents in Obstetrics through Arrangement of Services. Supervision of Work and Instruction. SIMUEL A. COSKOVY, M.D., Jersey City.

Palm Print Method of Infant Identification with Demonstration GILBERT P. POND, M D, Oak Park, Ill
 An Evaluation of Maternal Deaths (Outline of procedure developed by the Committees on Maternal Welfare of the medical societies of the counties of New York and Kings, for judging the responsibility in each case of pregnancy fatality) GEORGE W. KOSMAK, M.D., ALFRED M. HELLMAN, M.D., New York, and CHARLES A. GORDON, M.D., Brooklyn

Tuesday, 8:00 p.m. — Jansen Suite, Waldorf-Astoria Hotel
 Joint Session with the Greater New York Hospital Association

CLAUDE W. MUNGER, M.D., New York, presiding
 The Place of the Voluntary Hospital in Society DAVID H. MCALPIN PYLE, New York
 The Safeguarding of Trust Funds WILLIAM H. WALSH, M.D., Chicago
 The Advantages of Simplification and Standardization of Hospital Furnishings, Equipment, and Supplies L. M. ARROWSMITH, Brooklyn
 Trends in Hospital Insurance C. RUFUS ROREM, Ph.D., Chicago
 The Role of the Hospital in Graduate Medical Education R. C. BUECKI, M.D., Madison, Wis.

Wednesday, 9:30 — Sert Room, Waldorf-Astoria Hotel
 Joint Conference with Association of Record Librarians of North America
 JAMES T. NIX, M.D., New Orleans, presiding
 The Program of the Association of Record Librarians of North America as it Affects Hospitals. JENNIE C. JONES, R.R.L., Baltimore
 The Ills of Medical Records and Their Remedies Delay in Writing, Incompleteness, Unscientific Value, Insufficient Use GORDON R. KAMMAN, M.D., St. Paul
 The Medical Records Librarian Qualifications, Responsibilities, and Duties HELLN ROBINSON, R.R.L., Little Rock, Ark.
 How the Medical Records Librarian Can Assist the Physician in Securing Medical Records NORMA SWANSON, Red Wing, Minn.
 The New York Hospital Classified Nomenclature of Operations BRONSON S. RAY, M.D., New York
 Panel Discussion—Uses of the Medical Record
 Monthly Analysis Report for Medical Audit LEONARD SHAW, Chicago
 Making Group Studies of Diseases MARY M. NEWTON, B.A., R.N., Peoria, Illinois
 Preparing Scientific Papers ALFRED W. ADSON, M.D., Rochester
 Clinical Research FRANK E. ADAIR, M.D., New York
 Discussion Led by JOSEPH R. CLEMMONS, M.D., New York

Wednesday, 2:00 — Local Hospitals
 Demonstrations of Administrative and Technical Procedures in Local Hospitals
 Anesthesia New York Post-Graduate Medical School and Hospital
 The Care of Chronic Patients Montefiore Hospital
 Central Record Room and Follow-up System Mount Sinai Hospital
 Clinic Management Vanderbilt Clinic
 Food Service New York Hospital
 Isolation Technique Willard Parker Hospital
 Medical Social Service St. Luke's Hospital
 Nursing Service Queens General Hospital, Jamaica
 Oxygen Therapy Presbyterian Hospital
 Simplified Economical Method of Preparing Sterile and Parenteral Solutions Roosevelt Hospital

Thursday, 9:30 — Sert Room, Waldorf-Astoria Hotel
 R. C. BUECKI, M.D., Madison, presiding
 Symposium The Training of Hospital Executives
 Need for Adequate Education and Training for Hospital Executives JAMES A. HAMILTON, New Haven
 Discussion from the following viewpoints
 Apprenticeship in Hospital Administration DONALD C. SMLZER, M.D., Philadelphia
 Graduate and Undergraduate University Courses for Hospital Administrators GEPHARD HARTMAN, Chicago
 Institutes for Hospital Administrators NEAL N. WOOD, M.D., Chicago
 Supplementary Training and Experience in Hospital Administration—Reading, Observation Tours, and Attendance at Meetings GROPEL A. MACIVER, M.D., Worcester, Mass.
 Discussion Led by E. M. BLUESTONE, M.D., New York.

Thursday, 2:00 — Sert Room, Waldorf-Astoria Hotel
 Administrative Panel Round Table Conference (Section A)
 —a discussion of important questions and problems pertaining to various phases of hospital administration Conducted by Robert Jolly, Houston
 Administrative Practices Responsibility for scientific work of hospital Low cost hospital care versus rising cost of rendering services Financial security for employees Selection of hospital administrators Discussion led by BASIL C. MACLEAN, M.D., Rochester, N.Y.
 Hospital Personnel Problems Personnel turnover Personnel problems Hours, pay, and working conditions of personnel Trends in labor conditions Discussion led by JOSEPH G. NORBY, Milwaukee, Wis.
 Trustees' Maintaining interest of trustees Responsibility for professional standards Keeping informed regarding hospital administration Relations between board of trustees and medical staff Discussion led by C. MCGREGORY WELLS, JR., Southbridge, Mass.
 Business Management Financial classification of patients Annual deficit Reports Cost per patient day Discussion led by JAMES R. MAYES, Abington, Pa.
 Food Service Food control Unit meal costs Trends in food serving systems Evaluation of food service Discussion led by LENNA F. COOPER, New York.
 Hospital Auxiliaries Advantages Activities Relationship Knowledge of hospital Discussion led by MARY STONE CONKLIN, R.N., Hackensack, N.J.
 Linen and Laundry Service Linen circulation Unit linen supply Removal of stains and handling infected linen Advances in planning and equipping of the hospital laundry Discussion led by S. FRANK ROACH, Jersey City, N.J.
 House Management Personnel adjustments to meet work load Disinfection of rooms Responsibility for cleanliness Combination housekeeping, dietetics in the small hospital Discussion led by DORIS L. DUNGAN, Camden, N.J.
 The Small Hospital Personnel Laboratory and x-ray services Medical records Public relations Discussion led by A. EDWARD A. HUDSON, Waynesboro, Va.
 Discussion of questions or problems presented by the assembly

Thursday, 2:00 — LePerquet Suite, Waldorf-Astoria Hotel
 Administrative Panel Round Table Conference (Section B)
 —a discussion of important questions and problems pertaining to various phases of hospital administration Conducted by R. C. BUECKI, M.D., Madison, Wis.

Professional Practices Responsibility for professional standards. Major surgery privileges. Medical staff conferences. Criteria for evaluating scientific work of hospital. Discussion led by THOMAS R. PONTON, M.D., Chicago.

Clinical Laboratory Charges. Routine examinations. Disagreement in diagnosis. Pathological service in the small hospital. Discussion led by PHILIP HILLKOWITZ, M.D., Denver.

Anesthesia Organization of department. Types of anesthesia. Finances. Legal responsibility. Discussion led by WESLEY BOLLEA, M.D., Montreal.

Pharmacy Minimum standards. Registered pharmacist. Use of proprietary medicine. Economics. Discussion led by M. S. DOOLEY, M.D., Syracuse, N.Y.

Nursing Service Adjunct nursing personnel. Type of nursing service. Ratio of nurses to patients. Evaluation of nursing service. Discussion led by GRACE A. WARMAN, R.N., New York.

Medical Social Service The medical social worker. Minimum standards. Interest of the administration and medical staff. Evaluation of medical social work. Discussion led by MARY H. ROBERTS, Orange, N.J.

Physical Therapy Essentials of a physical therapy department. Therapeutic physical measures. Fever therapy. Procedure. Discussion led by A. G. HANSON, M.D., New York.

Occupational Therapy Advantages. Organization of department. Form of therapy. Financing of department. Discussion led by BYRON M. HARMAN, M.D., Verona, N.J.

Medical Records Evaluation. Case studies. Recorded pre-operative study. Writing medical records. Discussion led by JESSE W. HARTEN, F.R.C., Durham, P.C.

Discussion of questions or problems presented by the assembly.

PROGRAMS FOR EVENING SESSIONS

Presidential Meeting and Convocation—Monday, 8 00 P.M.—Ballroom, Waldorf-Astoria Hotel

Processional—Officers, Regents, and Honorary Guests

Invocation REV. HENRY DARLINGTON, D D., New York

Address of Welcome HENRY W CAVE, M D, New York, Chairman, Committee on Arrangements

Introduction of Foreign Guests FRANK W. LYNCH, M D, San Francisco, Vice President.

Address of Retiring President The American College of Surgeons—Retrospect and Prospect. FREDERIC A BESLEY, M D, Waukegan

Inauguration of Officers

President HOWARD C NAFFZIGER, M D, San Francisco

First Vice President VERNON C DAVID, M D, Chicago

Second Vice President FRASER B GURD, M D, MONTREAL

Presentation of Initiates for Fellowship. GEORGE CRILE, M D, Cleveland, Chairman, Board of Regents

Conferring of Fellowships by the President HOWARD C NAFFZIGER, M D, San Francisco

Conferring of Honorary Fellowships The President

Medical Records Honor List and Prize Award The President

Annual Oration on Surgery Our College Mandate—A Tribute to Allen B. Kanavel. WALTER W. CHIPMAN, M D, Montreal

Tuesday, 8 00 P M.—Ballroom, Waldorf-Astoria Hotel

Recurrent Hyperthyroidism RICHARD B. CATTELL, M D, Boston

Herniation through the Diaphragm. JOHN J MORTON, M D, Rochester, N. Y.

Contractures Due to Burns, Their Prevention and Cure WILLIAM T. COUGHLIN, M D, St Louis

Results with Repeated Stomach Operations, Especially Gastrojejunal Ulcers. PROF. HANS FINSTERER, Vienna

Brooklyn Night—Wednesday, 8 00 P.M.—Ballroom, Waldorf-Astoria Hotel

Address of Welcome DONALD E McKENNA, M D, Brooklyn, Chairman, Brooklyn-Long Island Committee on Arrangements, Presiding.

The Radical Operation for Cancer of the Stomach. W H OGILVIE, M D., F R.C.S (Eng.), London
Regional Ileitis.

Surgical Standpoint CHARLES G MIXTER, M D, Boston.

Medical Standpoint BURRILL B CROHN, M D, New York.

Treatment of Bronchiectasis.

Surgical Standpoint NORMAN S SHENSTONE, M D, Toronto.

Medical Standpoint. J. J SINGER, M D, Los Angeles.

Thursday, 8 00 P M.—Ballroom, Waldorf-Astoria Hotel

Surgery for Ulcerative Colitis FRED W RANKIN, M D, Lexington, Ky

The Psychiatrist in Relation to Surgery. FRANKLIN G EBAUGH, M D, Denver.

Benign Strictures of the Bile Ducts with a New Method of Treatment GEORGE E WILSON, M B, Toronto

Fracture Oration The Evolution of Fracture Treatment ISIDORE COHN, M D, New Orleans.

OPHTHALMOLOGY

Tuesday and Thursday, 8 00 P M —Sert Room, Waldorf-Astoria Hotel

Graduate Training in Ophthalmology HARRY S GRADLE, M D, Chicago

A New Visual Phenomenon Useful as a Functional Test in Subjectively Studying Action of Eye Muscles and Retina CLIFFORD B WALKER, M D., Los Angeles

Present Status of Lacrimal Sac Surgery. RALPH O RYCHENER, M D, Memphis

OTORHINOLARYNGOLOGY

Tuesday and Thursday 8 00 P M — Empire Room Waldorf Astoria Hotel

The Phylogenetic Development of the Ear JAMES MILTON ROBB, M D Detroit

The Treatment of Otitic Meningitis Due to Streptococcal Infection by Radical Surgery and Sulfanilamide
CARL H McCASKEY, M D Indianapolis

Graduate Training in Otolaryngology ALBERT C FURSTENBERG, M D, Ann Arbor Mich

Surgical Treatment of Laryngeal Tuberculosis FLETCHER D WOODWARD, M D HALSTEAD S HEDGES,
M D and FRANK B STAFFORD M D Charlottesville Va

A Study of Medical and Surgical Aid to Hearing JAMES A BABBITT M D Philadelphia

PROGRAMS FOR AFTERNOON SESSIONS

CANCER SYMPOSIUM

Tuesday 2 00 P M — Ballroom, Waldorf Astoria Hotel

Evaluation of Ovarian Sterilization for Breast Cancer GRANTLEY W TAYLOR M D Boston.

Discussion by RICHARD DRESSER M D Boston

Surgical Treatment of Laryngeal Cancer GORDON B NEW M D Rochester Minn

Discussion by ALBERT C FURSTENBERG, M D Ann Arbor Mich

The X Ray Treatment of Inoperable Cancer of the Larynx HENRI COUTARD M D Chicago

Discussion by HAYES E MARTIN M D New York

Surgical Treatment of Lung Cancer ALTON OCHSNER, M D New Orleans

Observations on Palliative Irradiation of Metastatic Tumors in the Lung ALEXANDER BRUNSCHWIG, M D
and ANNA HAMANN M D Chicago

SYMPOSIUM ON SURGICAL PROCEDURES ON THE HANDICAPPED PATIENT

Wednesday 2 00 P M — Ballroom Waldorf Astoria Hotel

Factors Determining Selection and Administration of Anesthetics WESLEY BOLRNE M D MONTREAL

Surgical Problems in Jaundiced Patients ROBERT S DYNAMORE M D Cleveland

Surgical Procedures on the Diabetic LELAND S MCKITTRICK M D Boston

Medical Aspects in Pre operative and Postoperative Care of Diabetic and Cardiac Patients JAMES E
PAULLIN, M D Atlanta Ga

SYMPOSIUM ON INDUSTRIAL MEDICINE AND TRAUMATIC SURGERY

Thursday 3 00 P M — Ballroom Waldorf Astoria Hotel

Importance of Dusts in Industry and Their Medical Control LEROY U GARDNER M D Saranac Lake N Y

Methods of Investigation of Occupational Skin Diseases LOUIS SCHWARTZ M D New York

Injuries to the Patella and Surrounding Tissues WILLIAM R CUBBINS M D Chicago

Diagnosis and Therapy of So called Posttraumatic Neurosis Following Cranio cerebral Injuries DONALD
MUNRO M D Boston

Problems in Rehabilitation after Injury EDWARD C HOLMELAD M D Chicago

Report of the 1938 Survey M N NEWLIST M D Chicago

SYMPOSIUM ON FRACTURES

Friday 2 00 P M — Ballroom Waldorf Astoria Hotel

Postgraduate Education in Fractures GEORGE A LELAND JR M D Boston

The Biretic Amputation HENRY H KESSLER M D, Newark

Double Pin Skeletal Fixation in Fractures of the Leg R ARNOLD GRISWOLD M D and GEORGE W
HOLMES, M D, Louisville

Fractures of the Bones of the Face JAMES B BROWN M D St Louis

Conservative Treatment of Fractures ELDRIDGE L ELIASON M D Philadelphia

SYMPOSIUM ON OBSTETRICS AND GYNECOLOGY

Friday, 2:00 P M —Sert Room, Waldorf-Astoria Hotel

Certain Aspects of So-called Sterility. ARCHIBALD D CAMPBELL, M D , Montreal

Experience with the Melhado Maneuver for Persistent Posterior Position GEORGE M WHITE, M D ,
St John, N B.

Ovarian Hormones and Carcinogenesis LUDWIG A EMGE, M D., San Francisco

The Management of Uterine Prolapse by Multiple Plastic Procedures EDWARD A SCHUMANN, M D ,
Philadelphia

Wertheim Operation for Cancer of the Uterus PROF PAUL WERNER, Vienna.

SYMPOSIUM ON UROLOGIC INFECTIONS

Friday, 2 00 P M —Le Perroquet Suite, Waldorf-Astoria Hotel

Obstructive Uropathies ALEXANDER RANDALL, M D , Philadelphia

Problems in Differential Diagnosis between Urologic Lesions and Abdominal Lesions HERMAN L KRETSCH-
MER, M D , ChicagoSympathectomy for the Relief of Vesical Spasm and Pain Resulting from Intractable Bladder Infection
REED M NESBIT, M D , Ann Arbor, Mich

Renal Infections and Nephrolithiasis. GEORGE GILBERT SMITH, M.D , Boston

Pyelonephritis and Its Treatment WILLIAM F BRAASCH, M D , Rochester, Minn

MIDDAY ROUND TABLE CONFERENCES

12 00 M to 1 00 P M —Waldorf-Astoria Hotel

TUESDAY

Jansen Suite

Infections in Surgery. MONT ROGERS REID, M D , Cincinnati, Presiding

Collaborators DEAN LEWIS, M D , Baltimore, URBAN MAES, M D , New Orleans, MICHAEL L
MASON, M D , Chicago, ALLEN O WHIPPLE, M D , New York*Blue Room*

Shock ALFRED BLALOCK, M D , Nashville, Presiding

Collaborators WILLIAM DEWITT ANDRUS, M D , New York, NORMAN E FREEMAN, M D , Phila-
delphia, CARL H LENHART, M D , Cleveland, DALLAS B PHEMISTER, M D , Chicago*Carpenter Suite*

The Immediate Repair of Cutaneous Defects SUMNER L KOCH, M D , Chicago, Presiding

Collaborators JAMES B BROWN, M D , St Louis, EARL C PADGETT, M D , Kansas City, Mo ,
GEORGE WARREN PIERCE, M D , San Francisco, JEROME P WEBSTER, M D , New York*Assembly Suite*

Thoracic Surgery WILLIAM F RIENHOFF, JR , M D , Baltimore, Presiding

Collaborators. NORMAN S SHENSTONE, M D , Toronto, WALTER ESTELL LEE, M D , Philadelphia.

WEDNESDAY

Blue Room

The Choice of Anesthetic JOHN S LUNDY, M D , Rochester, Minn , Presiding

Collaborators WESLEY BOURNE, M D , Montreal, WILLIS D. GATCH, M D., Indianapolis; RALPH
M WATERS, M.D , Madison, Wis

Jan en Suite

Cranioerebral Injuries CLAUDE C COLEMAN M D, Richmond Presiding

Collaborators B NOLAND CARTER M D, Cincinnati, DONALD MUNRO M D, Boston.

Empire Room

The Surgical Problem of Hypertension LOYAL DAVIS, M D Chicago Presiding

Collaborators IRVINE HEINLY PAGE M D Indianapolis GEORGE J HEUER M D New York

REGINALD H SMITHWICK M D, Boston ALFRED W ADSON M D Rochester, Minn

Assembly Suite

The Operative Treatment of Hyperparathyroidism EDWARD D CHURCHILL M D, Boston Presiding

Collaborators J DELLINGER BARNEY M D Boston, JOHN J MORTON M D Rochester, N Y,

DALLAS B PHEMISTER M D Chicago

FRIDAY

Le Perroquet Suite

The Treatment of Open Wounds ROY D McCLURE M D Detroit, Presiding

Collaborators L KRAERER FERGLSON M D Philadelphia EDWARD L HOWES M D Washington

MONT ROGERS REID M D Cincinnati

Jansen Suite

The Prevention of Postoperative Pulmonary Complications EMILE HOLMAN M D San Francisco Presiding

Collaborators CLAUDE S BECK M D Cleveland, ELLIOTT C CUTLER M D Boston WILLIAM F RIENHOFF JR M D Baltimore

Assembly Suite

Infections in Obstetrics JOHN FRASER M D Montreal Presiding

Collaborators FRED L ADAIR M D Chicago ALFRED C BECK M D Brooklyn GEORGE W KOSMAK, M D New York, ARTHUR H MORSE M D New Haven

Blue Room

Cancer of the Prostate HUGH H YOUNG, M D Baltimore Presiding

Collaborators WILLIAM F BRAASCH M D Rochester Minn ALEXANDER RANDALL M D Philadelphia GEORGE GILBERT SMITH, M D Boston

ASSEMBLY OF INITIATES

Monday 3 00 P M --Ballroom Waldorf Astoria Hotel

Proces sional--Initiates Officers Regents and Governors

Opening Remarks. FREDERIC A BESLBY M D, Waukegan President

The Program of the American College of Surgeons

IRVIN ABELL M D Louisville Vice Chairman Board of Regents

BOWMAN C CROWELL M D, Chicago Associate Director

MALCOLM T MACEachern M D, Chicago Associate Director

The Fellowship Pledge Recital by Initiates

Greetings to the Initiates HOWARD C NAFFZIGER M D San Francisco President-elect

Closing Remarks GEORGE CRILE M D, Cleveland Chairman Board of Regents

Signing of the Fellowship Roll by the Initiates

Reception to Initiates and Fellows

PROGRAM FOR THE 1938 CLINICAL CONGRESS

ARRANGED IN THE FOLLOWING SUBDIVISIONS: GENERAL SURGERY, OBSTETRICS AND GYNECOLOGY, SURGERY OF BONES AND JOINTS, GENITO-URINARY SURGERY, FRACTURES AND TRAUMATIC SURGERY, THORACIC SURGERY, NEUROSURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, OPHTHALMOLOGY, OTOLARYNGOLOGY.

NEW YORK—GENERAL SURGERY

Monday

BELLEVUE HOSPITAL

E A ROVENSTINE and staff—2 Symposium on anesthesia
Anesthetic management of patients with hyperactive
carotid sinus reflexes, therapeutic nerve blocks, for
angina, intractable pain, etc., demonstration of the
technique of oropharyngeal insufflation of oxygen

BETH ISRAEL HOSPITAL

HARRY E ISAACS and staff—2 Operations, with particular
reference to diseases of the gall bladder Dry clinic
Cholecystectomy without drainage, common duct ob-
struction, resectable liver tumors

FLOWER-FIFTH AVENUE HOSPITAL

J H FOBES and associates—2 Tumor clinic
THOMAS H MCGAVACK Lymphosarcoma Medical
aspects of suprarenal tumors
J C HOWARD Hodgkins disease
F J BORELLI and W E YOULAND
L R KAUFMAN Surgical aspects of suprarenal tumors
L C REID and F D SPEER Pathology
G H ADLER Endocrine aspects
J. H. FOBES Report of angiosarcoma of the cauda
equina, intensive x-ray treatment and operation, re-
sult at end of 21 years, with presentation of patient
J H FOBES, W E YOULAND, and J C HOWARD Sym-
posium on breast cancer
J H FOBES, D B HILL, J C HOWARD, and W E
YOULAND Fibrolipoma of the cecum with intus-
susception, fibrolipoma of the rectum

FORDHAM HOSPITAL

E R CUNNIFFE, R E WALSH, and ALFRED G. FORMAN—
2 Operative and dry clinics

GOUVENEUR HOSPITAL

R T CARTER and R B LOBBAN—2 Diagnosis and surgi-
cal management of gall bladder disease

HARLEM HOSPITAL

LOUIS T WRIGHT—2 Operations and ward rounds
CLARENCE P HOWELL—2 Operations and ward rounds

LENOX HILL HOSPITAL

CARL EGGERS, OTTO C PICKHARDT, DE WITT STETTEN, and
staffs—2 Operations
Staff—2 Symposium on gastric and duodenal ulcer and
associated lesions
WILLIAM H STEWART Roentgen diagnosis of peptic
ulcer by the modern mucosal method
MAX LINHORN Intubation treatment of peptic ulcer
ABRAHAM L GARBAT Ambulatory treatment of peptic
ulcer

HENRY A RAFSKY Medical treatment of pyloric ob-
struction

CARL EGGERS Gastro-enterostomy in peptic ulcer

DEWITT STETTEN End results after resection for pep-
tic ulcer

OTTO C PICKHARDT Treatment of associated lesions
HERMANN FISCHER—2 Exhibition of moulages of patho-
logical specimens of gastro-intestinal tract

METROPOLITAN HOSPITAL

S T. GLASSER and ALBERT LESSER—1 30 Injection treat-
ment of varicose veins

MISERICORDIA HOSPITAL

ARTHUR S McQUILLAN—2 Symposium on thyroid gland
surgery, study of 2,000 cases
WILLIAM T DORAN, SR—3 30 Surgical judgment in
procedures of the upper abdomen

MOUNT SINAI HOSPITAL

RALPH COLP, PERCY KLINGENSTEIN, SIGMUND MACE, and
JOSEPH STENBUCK—1 15 Operations Dry clinic
Pancreatic reflux, palliative subtotal gastrectomy for
juxtacardiac gastric ulcer, study of failures after gastro-
enterostomy

NEW YORK CITY HOSPITAL

LYMAN W CROSSMAN and JAMES H KIDDER—2 Opera-
tions

NEW YORK FOUNDLING HOSPITAL

GEORGE R STUART and staff—2 Unusual surgical cases
roentgenological, pathological and surgical aspects

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

EDWARD W PETERSON—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

FRANK C YEOMANS—1 30 Proctological operation

ST LUKE'S HOSPITAL

Staff—2 30 Symposium on thyroid diseases
C L GILBERT Radiotherapy in toxic goiter
E HERBERT, JR. Incidence of malignancy in solitary
adenoma of thyroid
MORRIS K SMITH Amount of remnant in operations
for diffuse toxic goiter
G M GOODWIN Discussion of postoperative tetany

Scientific Exhibitions—Daily

Tumor exhibit F C WOOD, Director Department of
Pathology

New growths of the respiratory and gastro-intestinal
tracts E J RIAN, Director Department of X-Ray
Diagnosis

ST VINCENT'S HOSPITAL

MAURICE C O'SHEA—2 Severed tendons and nerves of the hand and forearm

ANTHONY ROTTINO—2 Pathological demonstration

SYDENHAM HOSPITAL

MILTON BODENHEIMER—2 Operations Various types of thyroid disease

Tuesday

BABIES HOSPITAL

EDWARD J DO OJAN WILLIAM G HEELS LOUIS M ROUSSELOT, and GEORGE H HUMPHREYS—9 Operations

Dry Clinics

EDWARD J DONOVA: Congenital duodenal obstructions

WILLIAM G HEELS Treatment of acute empyema

LOUIS M ROUSSELOT Treatment of general peritonitis in children

GEORGE H HUMPHREYS Retroperitoneal infections in children

BELLEVUE HOSPITAL

ARTHUR BURDICK and staff—9 30 Operations

J A McCREERY and staff—9 30 Operations

GULFORD DUDLEY and staff—9 30 Operations

Staff—2 Symposium on surgical diseases of the stomach

JACOB DICKSTEIN Roentgenologic diagnosis of gastric duodenal and gastric jejunal ulcers

JOHN A McCREERY Operative management of secondary gastric and duodenal ulceration including marginal ulcers

GULFORD S DUDLEY Inflammatory and benign tumors of the stomach and their surgical management

ARTHUR M WRIGHT FRANCES H BOGARDO and WILLIAM H BARBER Failures after gastropylorostomy clinical and experimental studies

ROLAND L MEIER Treatment of gastric ulcer

REYNOLD E CHURCH Surgical treatment of massive hemorrhage

J WILLIAM HINTON Surgical treatment of chronic duodenal ulcers

FLOWER FIFTH AVENUE HOSPITAL

HERBERT C CHASE—9 Breast operations and moton pictures

H D FURNISS and W P ECKES—9 Cases of intestinal obstructions

EARL H EATON and LOUIS PALERMO—9 Treatment of burns with horse serum and tannic acid

W G CRUMP—9 Carcinoma of rectum

J H FOKES—9 Carcinoma of colon

JOSEPH A SILEO—9 Thrombosis and embolism post operative care

L P FAUFMAN and J H FOKES and staffs—2 Operations

FORDHAM HOSPITAL

E R CUNIFFE R E WALSH and ALFRED G FORMAN—2 Operative and dry clinics

GOUVERNEUR HOSPITAL

FRANCIS M CONWAY—9 Diverticulitis of the colon

MORRIS M BERLICK—9 Diagnosis and treatment of penetrating wounds of the esophagus

JOSEPH GERSHANSKY—2 Injection treatment of hernia and varicose veins

HARLEM HOSPITAL

JOSEPH B STENBUCK—9 Operations and ward rounds

LEON GINSBURG—9 Operations

CHARLES S B CASSARA JOSEPH B STENBUCK FARROW R ALLEN IRA FINE ROBERT E CARTER NORMAN F LASKEY WILLIAM H MEYER BEY JAMES J BEE FRANCIS A TIMONEY JOHN R BRUCKNER ROBERT S WILKINSON and WILLIAM SNOW—10 30 Symposium on subcutaneous and penetrating wounds of the thorax and abdomen

HOSPITAL FOR JOINT DISEASES

MILTON BODENHEIMER and staff—9 Operations Thyroid surgery

ABRAHAM J BELLER and staff—9 Operations Gastrectomy for carcinoma of the stomach abdominopneumal resection for carcinoma of the rectum

HARRY GOLDMAN and staff—9 Proctological operations

KNICKERBOCKER HOSPITAL

GEORGE H SEMKEN—9 The cancer problem Symposium with lantern slides

LENOX HILL HOSPITAL

Staff—9 Dry clinic Affections of the thyroid gland and complications

ARTHUR F RAECHTER General survey of thyroid disease

JACOB GEIGER Value of basal metabolism tests in thyroid disorders

A S BILLGARTEN Medical treatment of thyroid disorders and associated endocrine disturbances including diabetes

THOMAS A DAVIS The psychiatric manifestations in hyperthyroidism

CLAUDE DE LA CHAPELLE Cardiovascular problems in the thyroid diseases

PAUL A SAGER The thyroid in relation to heart disease

WALTER T STENSON Postoperative care of patients with hyperthyroidism

EARL H FOKES Postoperative results in cases with hyperthyroidism

FRANCIS M DONOVILLE Postoperative tetany and its treatment

OTTO C PICKHARDT The use of A T 10 in postoperative tetany

CARL EGGER—2 Esophageal lesions with demonstration of patients

WM H STEWART and staff—2 Cinefluorographic demonstration of esophageal lesions

HERBERT W MEYER—2 Reconstruction operations for epithelioma of the face

ARTHUR STEIN—2 Lesions of the vulva lantern slides

LINCOLN HOSPITAL

KIRBY DWIGHT—9 Operations on the colon Dry clinic Peritonitis and ileus

FREDERICK H AMENDOLA SAMUEL ERSTEIN and RICHARD GILBERT—11 15 Diseases of the thyroid

LUTHERAN HOSPITAL

ALFRED G FORMAN and staff—9 Operations Staff—2 Dry clinic

JOHN P BRUCKNER Ludwig's angina

CHARLES S CASSARA Intestinal obstruction

ANGELO A ZINGARO Epiphyseal fracture

LOUIS FERROTTA Technique of spinal anesthesia and end results

MEMORIAL HOSPITAL

BRADLEY L COLEY—9 Amputation of leg for osteogenic sarcoma

IRVING E ADAIR—10 Radical amputation of breast for carcinoma

METROPOLITAN HOSPITAL

- J H FOBES and L R KAUFMAN, and staffs—9 Symposium Surgery of the stomach, liver, spleen and pancreas
- T B WEINBERG Roentgenological aspects
- DR McNEILL Gastroscopy
- LINN J BOYD and THOMAS H MCGAVACK Medical aspects
- J H FOBES and L R KAUFMAN Operations
- J H FOBES and JOHN S O HERRLIN, JR Demonstration of cases of pancreatic cysts
- ROY UPHAM, D B HILL and staffs Medical aspects of gastric ulcer
- Staff—1 30 Symposium on gastro-intestinal surgery
- D B HILL, J H FOBES, and J C HOWARD Lesions of the lesser curvature of the stomach, medical aspect, surgical aspect, motion pictures and lantern slides
- ROY UPHAM, J C HOWARD, A SACCONI, and L R KAUFMAN General management of gastric and duodenal ulcer, medical aspect, roentgenological and pathological aspects, surgical treatment
- CHARLES A HALBERSTAM, EDWARD J McCABE, and W W JOHNSON Report on perforation of gastric and duodenal ulcers
- L R KAUFMAN, J H FOBES, JOHN S O HERRLIN, JR, WILLIAM P ECKES, and EDWARD J McCABE The jaundice problem, report by the complete surgical staff
- J H FOBES and staff Report of two cases of solitary liver abscess
- H D FURNISS and W P ECKES Intestinal obstruction
- JOHN S O HERRLIN, JR Discussion of the water balance in treatment

MISERICORDIA HOSPITAL

- SAUL A RITTER—10 30 Tuberculosis of ileocecal valve simulating malignancy, and other unusual surgical cases
- LESTER BREIDENBACH—2 Phlebectomy for thrombosis
- MAURICE J COSTELLO—3 Surgical neoplasms of skin
- PETER RIZZO—3 30 Devices in skeletal surgery

MONTEFIORE HOSPITAL

- A A BERG and staff—2 Operations on the colon

MORRISANIA CITY HOSPITAL

- J LEWIS AMSTER—9 Operation demonstrating regional anesthesia

NEW YORK CITY CANCER INSTITUTE

- IRA I KAPLAN and associates—2 Symposium on cancer
- IRA I KAPLAN Treatment of carcinoma of the cervix in advanced cases
- BRAHAM H GOLDEN Palliative mastectomy
- GEORGE A CASHMAN Genito-urinary malignancy, especially carcinoma of the penis
- RUDOLPH V GORSCH Colostomy
- ANGELO M SALA Pathology of advanced malignancy
- DAVID E EHRLICH Pendant mastography in the diagnosis of carcinoma of the breast

NEW YORK CITY HOSPITAL

- FREDERIC BANCROFT and MARGARET STANLEY-BROWN—9 Thrombosis, thrombophlebitis, embolism

NEW YORK HOSPITAL

- GEORGE J HILIER and staff—9 Operative and dry clinics
- GEORGE J HILIER Surgical treatment of hypertension
- WILLIAM DIW ANDRUS Splenectomy
- WILLIAM F. MACFEE Surgical lesions of the mouth and jaws

- RALPH F BOWERS Results in 900 thyroidectomies
- BRONSON S RAY Organization of a follow-up department
- N CHANDLER FOOT Contribution of a laboratory of surgical pathology to a surgical service
- FRANK GLENN. Surgery of common bile duct

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

- ANNA HUBERT, MARY L EDWARDS, and FRANCES H BOGATKO—9 Surgical follow-up clinic
- ELISE S L'ESPERANCE—2 Tumor conference

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

- CARL EGGERS—9 Breast clinic (Skin and Cancer unit)
- THOMAS H RUSSELL—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- FREDERICK C KELLER—10 Cadaver demonstration, surgical anatomy
- ROBERT E BRENNAN—11 Operations
- JEROME M LYNCH—1 30 Operations, proctological
- RICHARD KOVACS—2 30 Lecture on physical therapy
- EDWARD L KELLOGG—3 30 Operations

PRESBYTERIAN HOSPITAL

- ALLEN O WHIPPLE and LOUIS M ROUSSELOT—9 Splenectomy
- WILLIAM BARCLAY PARSONS and LAWRENCE W SLOAN—9 Thyroid operations
- WALTER W PALMER, WILLIAM BARCLAY PARSONS, LAWRENCE W SLOAN, BERTRAM J SANGER, and ARTHUR P STOUT—10 Symposium on thyroid disease
- ALLEN O WHIPPLE, WILLIAM P THOMPSON, KENNETH R McALPIN, R WEST, LOUIS M ROUSSELOT, and ROBERT H E ELLIOTT—2 Symposium on blood dyscrasias and splenopathies

ROOSEVELT HOSPITAL

- Staff—9 Symposium on surgical management of intractable ulcerative colitis
- THOMAS T MACKIE Medical aspects
- HENRY W CAVE Operation, with discussion
- LAWRENCE SOPHIAN Pathological aspects
- Staff—2 Symposium on ulcers and carcinoma of the stomach
- HOWARD F SHATTUCK Medical aspects
- WILLIAM H BOONE Roentgen diagnosis
- CONDUCT W CUTLER, JR Indications for surgical treatment
- GORDON P McNEER Demonstration of gastroscopy

- GRANT P PENNOYER and JULIAN M FRESTON—3 30 Demonstration of various types of peripheral vascular diseases with differential diagnosis and the results of treatment

ST FRANCIS' HOSPITAL

- ALEXANDER NICOLL and staff—9 Cholecystectomy, cholecystectomy with exploration of common duct
- CHARLES VEJVODA and staff—9 Cholecystectomy, appendectomy, hemorrhaphy

ST LUKE'S HOSPITAL

- HENRY H M LYLE, JOHN DOUGLAS, EDWARD J DONOVAN, WILLIAM F MACFEE, MORRIS K SMITH, and staff—9 Operative and dry clinics
- B R SHORE Surgical treatment of epitheliomas of the face

WILLIAM F. MACFEE Obstruction of the small in
testines

E. D. TRUESDELL The prognosis in silent gallstones

EDWARD J. DOVONAN Congenital diaphragmatic
hernia

WILLIAM G. HEERS and WILLIAM T. GIBB JR. The
value of gastroscopy in diagnosis demonstration of
gastroscopy

ST VINCENT'S HOSPITAL

JOSEPH A. BRADY GEORGE R. STUART, HENRY V. WALSH

FRANK J. MCGOWAN BERNARD D. HANNAN and

FRANCIS V. THONEY—9 Operations

RAYMOND P. SULLIVAN CONSTANTINE J. MACGUIRE JR.

LOUIS F. SANMAY CLARENCE P. HOWLEY and JOHN H.

FOX—9 Operations

SYDENHAM HOSPITAL

MILTON BODENSEIMER—3 Dry clinic Stab and bullet
wounds of the chest and abdomen

UNITED STATES MARINE HOSPITAL

L. A. PALMER and staff—10 30 Symposium on gastric
surgery

L. A. PALMER and staff Surgical aspects

C. R. SMITH Pathological aspects

F. LIBERSON X-ray reports

J. A. BRASFIELD and HAROLD KELMAN—10 30 Sym-
posium on back injuries Surgical aspects neuro-
psychiatric aspects

HAROLD KELMAN and S. P. COOPER—2 Symposium on
peripheral vascular disease

L. A. PALMER and staff—2 Operative and dry clinic
Hernia

Thursday

BEEKMAN STREET HOSPITAL

Staff—9 Symposium on abdominal emergencies from
various clinical viewpoints ward rounds

ARTHUR H. TERRY JR. The acute abdomen in the
diabetic

ROBERT H. KENNEDY Ovarian conditions contributing
to an acute abdomen

SHAWND MAGE Retroperitoneal injury simulating
acute abdomen

JAMES H. HEYL Pseudopneumonic cyst following ab-
dominal trauma

ELIAS RUBIN Genito urinary tract injuries

CHARLES J. OPPENHEIM Coronary thrombosis

THOMAS M. LOWRY Acute allergic abdomen

MYRON A. SALLICK Perforated peptic ulcer

BELLEVUE HOSPITAL

Staff—9 30 Symposium on surgery of the thyroid

RODERICK V. GRACE and CARVES WEEKS Total thy-
roidectomy for heart disease four year results pro-
gressive exophthalmos following Graves disease
aberrant thyroid two cases interval surgery in the
patient with hyperthyroidism

RUSSEL H. PATTERSON Prevention and treatment of
complications in gastric surgery

H. M. WERTHEIM Demonstration of cervical plexus
anesthesia block lantern slides

H. A. D. O'CONNOR and JOSEPH NASH Evaluation of
postoperative thyroid results

ARTHUR S. MCQUILLAN Ossification of a thyroid
adenoma Hurthle's cell tumor of the thyroid gland
Hashimoto's disease of the thyroid gland epithelioid

carcinoma of the thyroid gland hyperparathyroidism
postoperative tetany treatment

ARTHUR M. WRIGHT and staff—9 10 Operations

FENWICK BEEKMAN and staff—2 Symposium on children's
surgery Treatment of fractures congenital anoma

burns problem cases

IRA I. KAPLAN and associates—2 Operative and dry
clinics Irradiation treatment of malignant and
benign lesions

IRA I. KAPLAN Treatment of carcinoma of the cervix
with radium

RIEVA ROSH Surface lesions including carcinoma of the
lip

DOROTHY BELL Primary and postoperative carcinoma
of the breast

MILTON FRIEDMAN Tumors of the upper respiratory
tract

SIDNEY RUBENFELD Lymphoblastomas

FLOWER FIFTH AVENUE HOSPITAL

I. R. KAUFMAN and J. H. FOSBES and staffs—2 Operations

J. H. FOSBES and associates—2 Symposium on gastro-
intestinal surgery lesions of the lesser curvature of
the stomach

D. B. HILL Medical consideration

J. H. FOSBES and J. C. HOWARD Surgical consideration
motion pictures and lantern slides general manage-
ment of gastric and duodenal ulcer

ROY UPHAM Medical consideration

J. C. HOWARD Roentgenology

L. C. REID Pathology

L. R. KAUFMAN Surgery

CHARLES A. HALBERSTAD EDWARD J. MCCABE and
WILLIAM WARNER JOHNSON Report of perforation of
gastric and duodenal ulcers

J. H. FOSBES L. R. KAUFMAN, JOHN S. O. HERRLIN JR.
W. P. ECKES and EDWARD J. MCCABE The jaundice
problem

H. D. FURNISS and W. P. ECKES Intestinal obstruc-
tions

JOHN S. O. HERRLIN JR. Discussion of water balance

FORDHAM HOSPITAL

ALEXANDER NICOLL JAMES H. KENYON and LOUIS
MARTON—9 and 1 Operative and dry clinics

GOUVENEUR HOSPITAL

J. F. LEDMANN—9 Operations

HARLEM HOSPITAL

RALPH H. YOUNG—9 Operations

CHARLES S. B. CASSARA—9 Operations

LOUIS T. WRIGHT JOSEPH G. LEVY SOLOMON WEIN-
TRAUB FREDERICK A. KASSEBOHM—10 Symposium on
lymphopaths venereum

LENOX HILL HOSPITAL

OTTO C. FICKHARDT CARL EGGERS DEWITT STETTIN and
staffs—9 Operations

LINCOLN HOSPITAL

EDWARD D. TRUESDELL—9 Operations on biliary tract

CHARLES S. ROGERS—10 30 Dry clinic Children's
surgery

JAMES K. LINCOLN JACOB FRIEDMAN and LEONARD
ORENS—11 15 Surgical complications of diabetes

MEMORIAL HOSPITAL

GEORGE E. BINKLEY—9 Resection for carcinoma of rec-
tum

GEORGE T. PACK—9 Resection for gastric carcinoma.
Staff—11 Cancer conference

METROPOLITAN HOSPITAL

THOMAS H MCGAVACK, CHARLES A HALBERSTAM, S T GLASSER, and ALBERT LESSER—9 Peripheral vascular diseases, with demonstration of arteriography, oscillography, Landis test and histamine test
DAVID WEEKS and associates—9 Report on experimental work in the production of renal hypertension and operative procedures for relief
J H FOBES, L R KAUFMAN, and staffs—9 Operations

MOUNT SINAI HOSPITAL

JOHN H GARLOCK, LEON GINZBURG, WILLIAM H MENCHER, and MOSES SWICK—15 Operations
Colonic surgery, obstructive jaundice Dry clinic
Ulcerative colitis, carcinoma of the esophagus

NEW YORK CITY HOSPITAL

PAUL K SAUER and staff—9 Operative and dry clinics
LESTER BLUM—9 Experimental cardiac surgery
W G TEERWILLIGER—9 Varicose veins
ROBERT T FINDLAY—9 Surgery in the poor-risk aged

NEW YORK HOSPITAL

GEORGE J HEUER and staff—9 Operative and dry clinics
FRANK GLENN Acute cholecystitis
WILLIAM F MACFEE Carcinoma of the large bowel
RALPH F BOWERS Terminal ileitis
CRANSTON W HOLMAN Pre- and postoperative studies of gastric secretion
WILLIAM M COOPER Carcinoma of the ampulla of Vater
J HERBERT CONWAY Leiomyosarcoma of the stomach

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNA HUBERT, MARY A JENNINGS, and ISABEL KNOWLTON—9 Operations
FRANCES BOGATKO—9 Varicose vein clinic

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

CARL EGGERS—9 Dry clinic Surgery of the head and neck
CHARLES G HEYD—9 Operations
EDWARD W PETERSON—9 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

JOHN J MCGRATH—11 Operations
VINCENT HURLY—130 Proctology, cadaver demonstration
J E HAMMETT—230 Operations

PRESBYTERIAN HOSPITAL

BEVERLY C SMITH, DAVID C BULL, LOUIS BAUMAN, and BYRON STOKELY—9 Operations Symposium on vascular disturbances of the extremities
JOHN M HANFORD, ARTHUR P STOLT, CUSHMAN D HAAGENSLN, MAURICE LENZ, and THEODORE P EBERHARD—2 Symposium on therapy of tumors of head and neck

ROOSEVELT HOSPITAL

HOWARD A PATTERSON—9 Thyroid clinic Followed by demonstration of cases with discussion of recurrent and persistent hyperthyroidism

HOSPITAL FOR RUPTURED AND CRIPPLED

CARL G BURDICK and associates—9 Symposium on hernia
JOHN E SULLIVAN. Postoperative complications
RODERICK V GRACE and VANSEL S JOHNSON Results of herniotomy in patients over fifty years of age.
FENWICK BEEKMAN Undescended testicle
NORMAN L HIGINBOTHAM Division of cord
BRADLEY L COLEY Injection treatment
DAVID GILLESPIE Fascial sutures in the repair of hernia
ROLAND L MAIER. Silk sutures in the repair of hernia
WILLIAM CRAWFORD WHITE—9 Demonstrations of cases of carcinoma of the thyroid gland with discussion of treatment
LEWIS S BOOTH, MALCOLM H MUNKITTRICK, and PAUL M WOOD—2 Demonstration of modern trends in anesthesia

ST FRANCIS' HOSPITAL

ROBERT B LOBBAN and staff—9 Subtotal gastrectomy, stomach cases

ST LUKE'S HOSPITAL

HENRY H M LYLE, JOHN DOUGLAS, EDWARD J DONOVAN, WILLIAM F. MACFEE, MORRIS K SMITH, and staff—9 Operations

ST VINCENT'S HOSPITAL

EDWARD V DENNEEN, FRANK J SERAFIN, WILLIAM P MACNAMARA, HENRY A WAHN, and JAMES F. BROWN—9. Operations
RAYMOND P SULLIVAN, JOHN A LAWLER, MAURICE C O'SHEA, THOMAS C CASE, FRANCIS M CONWAY, and JOHN A FALLON—9 Operations
RAYMOND P SULLIVAN—2 Malignant and non-malignant lesions of colon, surgical aspects
WILLIAM W MAVER X-ray demonstrations
ANTHONY ROTTINO Pathological demonstration
Staff—245 Symposium on hernia
CLARENCE P HOWLEY Diaphragmatic hernia
JOHN A LAWLER Paraduodenal and paravesical hernias
Staff—330 Symposium on perforated ulcer
FRANK J MCGOWAN Operative procedure
EDWARD V DENNEEN Five-year operative experience
J RAYMOND LUTZ Medical management
JOHN H MORRIS Follow-up experience

SYDENHAM HOSPITAL

CULLEN ADLERBLUM—9 Dry clinic Varicose vein injections
MEYER H FREUND—1030 Operations Perineal excision of the rectum for carcinoma, anorectal operations
LESTER J UNGER—230 Operations Blood transfusion—Unger method

UNITED STATES MARINE HOSPITAL

Staff—1030 Symposium on appendicitis
L A PALMER and staff Surgical aspects
C R SMITH Pathological aspects
J W KENNEDY X-ray findings
C FERGUSON and R MEE—1030 Symposium on rectal surgery
S P COOPER—1030 Hernia operations

VETERANS ADMINISTRATION HOSPITAL

FREDERICK W BANCROFT—9 Operations Gastric resection for pyloric obstruction, 2 cases Discussion of thrombosis and embolism

- ALLEN G FULLER—9 Operations Carcinoma of the rectum second stage
- H J BALLEW E P HALL and J P DELANEY—10 Operations Inguinal hernia repair with demonstration of sliding bladder, 2 cases end result cases stomach and intestinal nonmalignant.
- DEFOREST BALLOU JR—10 Operations Laryngofissure partial laryngectomy Dry clinic Carcinoma of the larynx
- B F HAYDEN Manager CARLETON BATES Clinical Director JAMES EWING, FRANK L. ADAIR and FRED W STEWART Consultants—1 Tumor conference
- ALLEN G FULLER Carcinoma of the stomach
- E LEVY Carcinoma of the lung
- J P PALMER Carcinoma of lip and tongue
- W G CRISTOFFERSEN Basal cell carcinoma and carcinoma of the rectum
- CHARLES F BLOOM Collaborated material
- R C HENDERSON Collaborated material
- DEFOREST BALLOU JR Carcinoma of the larynx
- H HERSCHER Hodgkins disease and lymphosarcoma

Friday

BELLEVUE HOSPITAL

- Staff—9 30 Symposium on gall bladder surgery
- CONSTANTINE J MCGUIRE Treatment of acute cholecystitis
- FRANK COTTE Intravenous medication in gall bladder disease
- IRA I KAPLAN Radiation therapy in disease of the biliary tract
- WILLIAM T DORAN Management of the gall bladder patient.
- ERNEST W LAMPE Acute pancreatitis in relation to biliary tract disease
- JOHN E SLITON JR Jaundice and common duct stone

BETH ISRAEL HOSPITAL

- PERCY KLINGENSTEIN and staff—2 Operations Graves disease gastroduodenal ulcer Dry clinic Pre operative radiation in carcinoma of the breast.
- I KROSS—2 Dry clinic Obstructive lesions of the small intestine Case presentations
- SAMUEL MURPHY—2 Dry clinic Unusual pre-operative complications of hernia

WILLIAM BOOTH MEMORIAL HOSPITAL

- WILLIAM T KENNEDY—9 Surgical treatment of incontinence of urine in women
- JOHN ROGERS and ARTHUR McQUILLAN—10 Thyroid clinic.
- GEORGE W KOSMAK and N CILBERT SEYMOUR Demonstration of medical and surgical facilities in a small private hospital run by the Salvation Army for people of moderate means.

FLOWER FIFTH AVENUE HOSPITAL

- J CLIFFORD HAYNER DEW R S BARNES and W L PRINACONE—9 The use of lemon oil as a skin antiseptic
- JOHN S O HERRLIN JR—9 Infections of the hand wax models motion pictures
- J H FOBES and L R KAUFMAN and staffs—2 Operations
- J H FOBES and S T GLASSER—2 The use of ox fascia in hernia operations
- J C HAYNER—2 Demonstration of new method in hernia operations
- L R KAUFMAN and W W JOHNSON—2 Demonstration of wire sutures.

- W W JOHNSON and ALBERT LESSER—2 Experimental work on dogs
- J D NORRIS—2 Studies in wound healing—dehiscence
- DAVID WEEKS and associates—2 Symposium on hypertension Report on experimental work in the production of the renal type and operative procedures for relief
- WILLIAM H BISHOP and J H FOBES—2 Intussusception of appendix outside of anus removal demonstration with lantern slides
- J H FOBES CHARLES HALBERSTAM and staff—2 The present status of appendicitis demonstration of a new operation, motion pictures
- DONALD E BRACE and staff—2 Contribution of a department of anesthesia to a surgical service
- L C PEID—2 Contribution of a laboratory of surgical pathology to a surgical service

FRENCH HOSPITAL

- ARTHUR M WRIGHT and staff—9 Symposium on diseases of the gall bladder Cholecystitis in elderly people treated by cholecystogastrostomy stone in the common duct poor operative risk cholecystogastrostomy patient living ten years later choledochoduodenostomy for recurrent obstruction of common bile duct rubber tube implantation five months resection of sigmoid for carcinoma complicated by intestinal obstruction by gall stones pathological discussion by Dominic Anthony DeSanto

FOPDHAM HOSPITAL

- E R CUNNINGHAM R E WALSH and ALFRED G FORMAN—2 Operative and dry clinics.

GOVERNEUR HOSPITAL

- MICHEL G ELIAS—2 Perforated gastric and duodenal ulcer
- F J MCGOWAN—2 Discussion of above
- BORIS KORNBLITH—2 Lymphogranuloma venereum

HARLEM HOSPITAL

- Staff—9 Dry clinics
- CHARLES S B CASSA A ALEXANDER ALTSCHILL and staff Thyroid disease
- LEON GRZEBEC Intestinal obstruction
- JAMES C WHITAKER Fat embolism
- ALBRE DEL MAYNARD Treatment of burns
- U CONRAD VINCENT Surgical lesions of the terminal ileum cecum, and the ascending colon

KICKERBOCKER HOSPITAL

- JOHN V BOHRER C JOSEPH DELANEY and PRO V PREWITT—9 Operative and dry clinic Surgery of the stomach and gall bladder

LENOX HILL HOSPITAL

- Staff—10 30 Symposium on lesions of the colon
- WILLIAM H STEWART Differential diagnosis between carcinoma diverticulitis and sigmoiditis
- CARL EGGERS Diverticulitis and sigmoiditis
- DEWITT STETTEN Carcinoma of the colon and its radical treatment
- HERRERT W MEYER Radical operations for carcinoma of the rectum
- JOHN C A GLASTER Conservative operations for carcinoma of the rectum
- Exhibition of moulages of pathological specimens of the gastro intestinal tract.

LINCOLN HOSPITAL

- BRADLEY L COLEY—9 Management of bone tumors in a general hospital.

- BENJAMIN SHERWIN—9 45 Complications in hernia operations
 PETER VOGEL—10 45 Management of a blood bank in a municipal hospital

MEMORIAL HOSPITAL

- HAYES E. MARTIN—9 Hemilaryngectomy for carcinoma
 GEORGE T. PACK—9 Intrascapulothoracic amputation for melanoma
 Staff—10 Demonstration of x-ray and radium equipment
 Inspection of new Memorial Hospital

METROPOLITAN HOSPITAL

- J. H. FOBES and L. R. KAUFMAN, and staffs—9 Operations
 Staff—9 Dry clinics
 H. D. FURNISS and W. P. ECKES Discussion of intestinal obstruction
 JOHN S. O. HERRLIN, JR. Water balance
 J. H. FOBES and DR. CHASEL Breast
 J. H. FOBES Discussion of ox fascia in the repair of hernias
 L. R. KAUFMAN, W. W. JOHNSON, and ALBERT LESSLER Demonstrations of wire sutures in hernia with a report of experimental work on dogs
 J. H. FOBES, J. CLIFFORD HAYNER, and CHARLES A. HALBERSTAM Report on the present status of appendicitis
 J. WALSH Report on the value of rebound tenderness

MORRISANIA CITY HOSPITAL

- GEORGE E. MILANI—2 Operation for repair of large hernias by fascial flaps
 WILLIAM KLEIN—3 30 Treatment of acute mesenteric lymphadenitis

NEW YORK CITY CANCER INSTITUTE
(Welfare Island Hospital)

- IRA I. KAPLAN and associates—2 Symposium on cancer
 IRA I. KAPLAN Demonstration of cancer cases
 LIONEL S. AUSTER Surgical problems of advanced cancer, illustrated by specific cases
 DAVID E. EHRLICH Interesting roentgenograms of advanced cancer cases

NEW YORK CITY HOSPITAL

- ISIDORE KROSS and staff—9 Operative and dry clinics

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

- MARY L. EDWARDS, EMMA S. ARONSON, and MARGARET STANLEY-BROWN—9 Operations
 ASTA J. WITTMER and SOPHIE SPITZ—9 Sterility clinic

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

- THOMAS H. RUSSELL—9 Operations
 CARL EGGERS—2 Operations Breast, head, and neck cases
 JOHN F. ERDMANN—2 30 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- HERBERT C. CHASE—11 Operations
 WILLIAM M. COOPER—2 30 Lecture and demonstration on varicose veins

PRESBYTERIAN HOSPITAL

- ALLEN O. WHIPPLE and staff—9 Operations Pancreas
 Dry clinic and follow-up, pancreatic lesions
 DANA W. ATCHLEY, JOHN SCUDDER, and OCTA C. LEIGH—2 Symposium on fluid loss and fluid balance in surgery
 F. B. ST. JOHN, H. D. HARVY, C. A. FLOOD, and ROSS GOLDEN—2 Symposium on gastric and duodenal lesions

ROOSEVELT HOSPITAL

- CONDUCT W. CUTLER, JR.—9 Gastric resection for carcinoma of the stomach
 ALFRED STILLMAN II—9 Resection of the colon for carcinoma

ST. FRANCIS' HOSPITAL

- ROBERT B. LOBBAN and staff—9 Operations for primary hyperthyroidism, secondary hyperthyroidism, and non-toxic thyroid

ST. LUKE'S HOSPITAL

- HENRY H. M. LYLE, JOHN DOUGLAS, EDWARD J. DONOVAN, WILLIAM F. MACFEE, MORRIS K. SMITH, and staff—9 Operative and dry clinics
 W. H. BERRY Treatment of endocervicitis by electro-coagulation
 FREDERICK W. SOLLEY Injection treatment of hydrocele
 H. J. SHELLEY Injection treatment of varicose veins
 P. C. MORTON Demonstration of rolling proctologic equipment table, relation of solitary polyps to carcinoma of the colon
 G. E. BURFORD Problems in organization of a department of anesthesia

ST. VINCENT'S HOSPITAL

- LOUIS F. SANMAN—2 Symposium Surgical jaundice
 FRANCIS X. TIMONIA—3 Effect of iodine on the thyroid gland as seen in stage thyroidectomies
 ANTHONY ROTTINO—3 Pathological demonstrations

GENITO-URINARY SURGERY

Monday

HOSPITAL FOR JOINT DISEASES

- PALL W. ASCHNER, IRVING SIMONS, J. SIDNEY RITTER, and WILLIAM BISHOP—2 Operations Nephrectomy for tuberculosis, aseptic technique, pyelonephrolithotomy, pelvic ureterolithotomy Dry clinics Evaluation of excretion urography, cystometry and sphincterometry in diagnosis, seminal vesicles, diagnosis and therapy, selection of procedures in prostatic hypertrophy

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- DANIEL A. SINCLAIR—3 30 Operations

SYDENHAM HOSPITAL

- RALPH L. DOURASHKIN—2 Lesions in the female urethra, relationship of bone fractures to formation of calculi in the urinary tract, treatment of urethral calculi with rubber bags and metallic dilators

Tuesday

FLOWER FIFTH AVENUE HOSPITAL

SPRAGUE CARLETON and staff—9 Kidney and prostate surgery demonstration of clinic apparatus models and sketches

MEMORIAL HOSPITAL

BENJAMIN S BARRINGER—10 Suprapubic cystostomy for carcinoma

METROPOLITAN HOSPITAL

SPRAGUE CARLETON and staff—1 30 Operations

MORRISANIA CITY HOSPITAL

TERRY M TOWNSEND—1 30 Operation Prostatic obstruction

JOHN DUFF— Dry clinic Urological malignancies

JOHN J ROTH—2 30 Diverticula of the bladder

NEW YORK CITY HOSPITAL

THOMAS J KIRWIN—2 Operative and dry clinics

NEW YORK HOSPITAL

ALEXANDER RAYMOND STEVENS OSWALD TOWSELEY and staffs—2 Operative and dry clinics

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE E KUEHLER—9 Dry clinic

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

JOSEPH A HYAMS—2 Operative and dry clinics

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff—3 Operations

RIVERSIDE HOSPITAL

SIMON A BEISLER—3 Urogenital conditions in the tuberculous

UNITED STATES MARINE HOSPITAL

C FERGLSON and K A MEE—2 Symposium on prostatic surgery

WOMAN'S HOSPITAL

HENRY G BUGBEE— Nephrectomy for pyonephrosis genito-urinary problems in relation to gynecology and obstetrics

ALBERT H ALDRIDGE—2 Treatment of postoperative vesicovaginal fistula demonstration of new technique lantern slides

Thursday

BELLEVUE HOSPITAL

ALEXANDER K STEVENS and staff—9 30 Symposium on urinary calculus

ALEXANDER K STEVENS and staff—2 Operations

BETH ISRAEL HOSPITAL

Staff—2 30 Operative and dry clinics

ABRAHAM HYMAN Differential diagnosis of renal and suprarenal tumors with lantern slides

SEYMOUR E WELCHER Diagnosis and operative treatment of male sterility with lantern slides Presentation of cases of unusual interest

FLOWER FIFTH AVENUE HOSPITAL

SPRAGUE CARLETON and staff—9 Kidney and prostate surgery demonstration of clinical apparatus model and sketches

FRENCH HOSPITAL

CHARLES H CHITWOOD and JOHN DENNIS GOODEY—9 Treatment of lacerated kidney and ureter demonstration of cases lacerations of bladder lacerations of urethra injuries to testes

LINCOLN HOSPITAL

DAVID FEERINGER FRANCIS P TWISSEN JORGE CAMPOZA O, and ISIDORE PALAIS—9 Operations

NEW YORK CITY HOSPITAL

JOHN H MORRISSEY—2 Ictenial surgery

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE KUEHLER—9 Dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

J JOSEPH MCCARTHY—3 30 Operations

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff— Symposium on tumors of the kidney

ROOSEVELT HOSPITAL

SIMON A BEISLER—2 Transurethral prostatectomy suprapubic prostatectomy nephrectomy

ST LUKE'S HOSPITAL

Staff—10 30 Dry clinic

HENRY H M LYLE Ombredanne operation for hypospadias

HENRY G BUGBEE Neoplasms of the urinary tract

C I HOCH Urinary calculi

J A TAYLOR Transurethral resection

A J MURPHY Urologic complications following hysterectomy

Friday

FLOWER FIFTH AVENUE HOSPITAL

SPRAGUE CARLETON and staff—9 Kidney and prostate surgery demonstration of clinical apparatus models and sketches

LENOX HILL HOSPITAL

Staff—9 Symposium on affections of the urinary tract and their treatment

GEORGE W SLAUGHTER Use of sulfanilamide in urological infections

HARBERT W MEYER Case presentations Conservative surgery of strictures of the uretero-pelvic junction repair of hypo spadias—late result

WILLIAM R DELZELL Perirenal air insufflation as an aid in diagnosis motion pictures

PETER A NARATH The role of the hydromechanics in the renal pelvis in genito-urinary infections

HARBERT R KENYON The present status of trans urethral prostatic resection

MAXIMILIAN M NEUBER Presentation of interesting cases of renal tumors

LUTHERAN HOSPITAL

TERRY M TOWNSEND—2 Operations Surgery of hypertrophied prostate

METROPOLITAN HOSPITAL

SPRAGUE CARLETON and staff—1 30 Operations

MISERICORDIA HOSPITAL

MAXIMILIAN NEMSER and HUBERT LYONS—9 30 Symposium on tumors of the urinary tract
HUBERT LYONS Diagnosis of renal, ureteral and vesical tumors

MAXIMILIAN NEMSER Management of tumors of the urinary tract, pyelographic changes in various types of renal tumors, lantern slides

ROBERT C SCHLEUSSNER—11 Pathologic classification of tumors of the urinary tract, demonstration of gross and microscopic specimens

MOUNT SINAI HOSPITAL

GORDON D OPPENHEIMER and MOSES SWICK—1 15 Operative and dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL

DAVID GEIRINGER—3 30 Operations

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff—2 Operations.

ST VINCENT'S HOSPITAL

HERBERT MOHAN, WLNELL J WASHBURN, T F HOWLEY, E CRAIG COATS, and G J MCCA—9 Operations

SYDENHAM HOSPITAL

SAMUEL LUBASH—9 Operations Plastic repair of the kidney pelvis in hydronephrosis

SAMUEL MALISOIT—10.30 Operations Transurethral resections for vesical neck obstructions

LOUIS FRILDMAN—1 Operations

OBSTETRICS AND GYNECOLOGY

Monday

BETH ISRAEL HOSPITAL
(Jewish Maternity Hospital)

SAMUEL J SCADRON and EDWIN G LANGROCK—2 Obstetrical operations Dry clinic Cesarean section, demonstration of forceps delivery

HARLEM HOSPITAL

HENRY C FALA, PETER M MURRAY, and MURRY H LEVINE—2 30 Organization of gynecological service in the large city institution

FREDERICK A KASSEBOHM—3 Placenta praevia

LYING-IN HOSPITAL

H J STANDER—2 Staff conference Heart disease complicating pregnancy, dystocia in a patient with a contracted pelvis

METROPOLITAN HOSPITAL

HORACE AYERS and staff—1 30 Dry clinic Transplantation of ovaries, motion pictures, cardboard demonstration, presentation of patient

DONALD E BRACE and staff—1 30 Collection of placental blood for indirect transfusions, motion pictures

L S LOIZEAUX and staff—1 30 Obstetrical and gynecological problems

MOUNT SINAI HOSPITAL

SAMUEL H GEIST and staff—1 30 Operative clinic The treatment of prolapse, cystocele and incontinence in three typical cases

NEW YORK POST-GRADUATE MEDICAL
SCHOOL AND HOSPITAL

MORTIMER N HYAMS and staff—2 Dry clinic Uterosalingography by fractional injections of lipiodol, sterilization of the female as an office procedure, conization of the uterine cervix

PRESBYTERIAN HOSPITAL
(Sloane Hospital for Women)

W W HERRICK, ALVIN J B TILLMAN, and JEAN CORWIN—2 Symposium on the toxemias and other complications of pregnancy

RIVERSIDE HOSPITAL

NELSON B SACKETT—2 Gynecological complications in advanced pulmonary tuberculosis

WOMAN'S HOSPITAL

WILLIAM T KENNEDY—2 Complete abdominal hysterectomy for fibroids, operation for incontinence of urine, cystocele, rectocele, laceration of pelvic floor, demonstration of Kennedy technique and end results

RALPH L BARRETT—2 Electrocoagulation of cervix, two cases, demonstration of technique and end results

Tuesday

BELLEVUE HOSPITAL

E W HOLLADAY—9 Operations Repair of old third-degree laceration

WM E STUDDIFORD—9. Operations Repair of cystocele and rectocele, suspension of uterus

CLAUDE HEATON—9 Obstetrical ward rounds, complications of pregnancy, x-ray pelvimetry

HOWARD C TAYLOR, JR—2 Care of patients suffering from gynecological malignancy

WM E STUDDIFORD and HOWARD C TAYLOR, JR—3 30 Demonstration of pathological material

BETH ISRAEL HOSPITAL

Staff—9 Gynecological dry clinic

HERMAN LORBER Carcinoma of fallopian tubes, carcinoma of ovary with peritoneal implants, five years after operation, early carcinoma of uterus

MAURICE RASHBAUM The diagnosis and management of urinary incontinence

SEYMOUR WINPHREIMER Chorioepithelioma

E A HOROWITZ The treatment of gonorrhea in women by systemic hyperpyrexia and simultaneous pelvic heating—an evaluation of 7½ years' experience Rationale of treatment, indications, technique, apparatus required, results in lower genital tract infections, in salpingitis and in gonorrheal arthritis, late results, treatment of gonorrhea in women by sulfanilamide, fever therapy combined with pelvic heating, treatment of a female patient with gonorrhea

MORTON VESELL Dysgerminoma of ovary, granulosa cell tumor of ovary

HERMAN LORBER and staff—2 Operations Manchester operation for prolapse, vaginal hysterectomy, operation for incontinence

FLOWER-FIFTH AVENUE HOSPITAL

HORACE AYRES and staff—2 Transplantation of ovaries, cardboard demonstration, motion pictures and presentation of patient

*Tuesday***FLOWER FIFTH AVENUE HOSPITAL**

SPRAGUE CARLETON and staff—9 Kidney and prostate surgery demonstration of clinic apparatus models and sketches

MEMORIAL HOSPITAL

BENJAMIN S BARRINGER—10 Suprapubic cystotomy for carcinoma

METROPOLITAN HOSPITAL

SPRAGUE CARLETON and staff—1 30 Operations

MORRISANIA CITY HOSPITAL

TERRY M TOWNSEND—1 30 Operation Prostatic obstruction

JOHN DUFF—2 Dry clinic Urological malignancies

JOHN J ROTH—2 30 Diverticula of the bladder

NEW YORK CITY HOSPITAL

THOMAS J ALLEN—2 Operative and dry clinics

NEW YORK HOSPITAL

ALEXANDER RAYMOND STEVENS OSWALD TOWSELEY and staffs—2 Operative and dry clinics

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE E KUNVER—9 Dry clinic

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

JOSEPH A HYAMS—2 Operative and dry clinics

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff—2 Operations

RIVERSIDE HOSPITAL

SIMON A BEISLER—3 Urogenital conditions in the tuberculous

UNITED STATES MARINE HOSPITAL

C FERGUSON and R A MEE—2 Symposium on prostatic surgery

WOMAN'S HOSPITAL

HENRY G BLOECC—2 Nephrectomy for pyonephrosis; genito urinary problems in relation to gynecology and obstetrics

ALBERT H ALDRIDGE—2 Treatment of postoperative vesicovaginal fistula demonstration of new technique lantern slides

*Thursday***BELLEVUE HOSPITAL**

ALEXANDER R STEVENS and staff—9 30 Symposium on urinary calculus

ALEXANDER R STEVENS and staff—2 Operations

BETH ISRAEL HOSPITAL

Staff—2 30 Operative and dry clinics

ABRAHAM HYMAN Differential diagnosis of renal and suprarenal tumors with lantern slides

SEYMOUR F WITTELMAN Diagnosis and operative treatment of male sterility with lantern slides Presentation of cases of unusual interest

FLOWER FIFTH AVENUE HOSPITAL

SPRAGUE CARLETON and staff—9 Kidney and prostate surgery demonstration of clinical apparatus models and sketches

FRENCH HOSPITAL

CHARLES H CRAFTWOOD and JOHN DENNIS GOONEY—9 Treatment of lacerated kidney and ureter demonstration of cases lacerations of bladder lacerations of urethra injuries to testes

LINCOLN HOSPITAL

DAVID CEIRINGER FRANKS P TWINEM JORGE CAMPE ZIMO and ISIDOR J BLAIS—9 Operations

NEW YORK CITY HOSPITAL

JOHN H MORRISSEY—2 Penneal surgery

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

ANNE KUNVER—9 Dry clinic

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

F JOSEPH MCCARTHY—3 30 Operations

PRESBYTERIAN HOSPITAL

J BENTLEY SQUIER and staff—2 Symposium on tumors of the kidney

ROOSEVELT HOSPITAL

SIMON A BEISLER—2 Transurethral prostatectomy suprapubic prostatectomy nephrectomy

ST LUKES HOSPITAL

Staff—10 30 Dry clinic

HENRY H M LYLE Ombredanne operation for hypospadias

HENRY G BLOECC Neoplasms of the urinary tract

C F HOOK Urinary calculi

J A TAYLOR Transurethral resection

A J MURPHY Urologic complications following hysterectomy

*Friday***FLOWER FIFTH AVENUE HOSPITAL**

SPRAGUE CARLETON and staff—9 Kidney and prostate surgery demonstrations of clinical apparatus models and sketches

LENOX HILL HOSPITAL

Staff—9 Symposium on affections of the urinary tract and their treatment

GEORGE W SLAGHTER Use of sulfanilamide in urological infections

HERBERT W MEYER Case presentations Conservative surgery of strictures of the uretero pelvic junction repair of hypospadias—late result

WILLIAM R DRILLILL Perirenal air insufflation as an aid in diagnosis motion pictures

PETER A NARATH The role of the hydromechanics in the renal pelvis in general body infections

HERBERT R KERNON The present status of transurethral prostatic resection

MAXIMILIAN M NEMSER Presentation of interesting cases of renal tumors

LUTHFRAN HOSPITAL

TERRY M TOWNSEND—2 Operations Surgery of hypertrophied prostate

METROPOLITAN HOSPITAL

SPRAGUE CARLETON and staff—1 30 Operations

HARLEM HOSPITAL

- HENRY C FALK, PETER M MURRAY, and MURRY H. LEVINE—9 Classification and management of the infected abortion, operations
A CHARLES POSNER—3 Breach presentation, Methods employed to reduce foetal and neonatal mortality

LINCOLN HOSPITAL

- EDWARD J DAVIN and staff—9 Use of intravenous ergonovine at the end of the second stage of labor, results in over 500 cases
HAROLD C INGRAHAM—2 Treatment of pelvic inflammatory disease by various modalities
ROBERT L CRAIG—2 Treatment of pelvic inflammatory disease by acetyl-beta-methyl-cholin
FRANK SPIELMAN—2 Gynecological pathology, some unusual ovarian neoplasms

LUTHERAN HOSPITAL

- JAMES T. PADGETT—9 Operations

LYING-IN HOSPITAL

- HENRICUS J STANDER—9 Operation for cure of cystocele and rectocele
HERBERT F TRAUT—9 Myomectomy and hysterectomy
HENRICUS J. STANDER—2 30 A study of acute yellow atrophy
HERBERT F TRAUT—3 The clinical and histological differentiation between hypertrophy and hyperplasia of the endometrium
JOHN B PASTORE—3 30 Anemia in pregnancy
ROBERT G DOUGLAS—4 Intrapartum infection and its relation to the time of cesarean section

METROPOLITAN HOSPITAL

- L S LOIZEAUX—9 Operations

MISERICORDIA HOSPITAL

- JAMES P HENNESSY—9 30 Modified Scanzoni for occiput posterior
F WALTER GRAVELLE—10 Forceps technique, single application for occiput posterior
ALEXANDER H SCHMITT—10 30 Complications requiring cesarean section
FREDERICK E NEEF—2 Application of radon ring in carcinoma of the uterine cervix
JOSEPH A DEVLIN—3 Operative indications in gynecological emergencies
FRANCIS W SOVAK—4 Operative treatment for sterility, lantern slides

MOUNT SINAI HOSPITAL

- ISIDOR C RUBIN—9 30 Ward rounds and demonstration of cases. Genital tuberculosis, kidney tumors, myomectomy, vaginal supravaginal hysterectomy and parametrial fixation for prolapse and myoma
ISIDOR C RUBIN and staff—2 Operations Parametrial fixation (Donald Fothergill) for prolapse of uterus, local analgesia, multiple myomectomy (show hippuran), laparotomy for salpingolysis, plastic for cystoectocoele, parasacral anesthesia, motion picture of parametrial fixation

NEW YORK INFIRMARY FOR WOMEN AND CHILDREN

- WILHELMINA A RAGLAND and associates—9 Toxemias of pregnancy, x-ray pelvimetry, care of prematures

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- LOUIS J LADIN—9 Operations

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

- THEODORE NEUSTAEDTER and staff—10 Clinical use of estrogenic hormones
ADOLPH JACOBY and staff—2 Treatment of pelvic exudates with iontophoresis

PRESBYTERIAN HOSPITAL

(Sloane Hospital for Women)

- BENJAMIN P WATSON and staff—9 Cesarean sections, obstetrical rounds, cardiac, toxemias and other complications
W E CALDWELL, HOWARD C MOLOY, and D ANTHONY D'ESOP—2 Diagnosis of pelvic abnormality, x-ray pelvimetry, the precision stereoscope in the mechanism of labor

ROOSEVELT HOSPITAL

- HOWARD C TAYLOR, THOMAS C PEIGHTAL, HOWARD C TAYLOR, JR, and WILSON E ALSOP—9 Operations Kennedy operation for bladder incontinence operation for cystocele and rectocele, tubal implantation of occluded tubes
THOMAS C PEIGHTAL, HOWARD C TAYLOR, JR, WILSON E ALSOP, and A V GREELEY—2 Dry clinic Pelvic cancer, postmenopausal bleeding, endometriosis, tubal implantation cases, demonstration of ovarian tumors

ST FRANCIS' HOSPITAL

- CHARLES VEJVODA and staff—9 Subtotal hysterectomy, total hysterectomy, salpingectomy, uterine suspension

SYDENHAM HOSPITAL

- JULIUS JARCHO—9 Operations
ALFRED M HELLMAN—2 Dry clinic Large mesenteric tumor, cornual pregnancy, Kennedy hysterectomy, presentation of patients and specimens, skiodan salpingography

WOMAN'S HOSPITAL

- RALPH A HURD—9 Cesarean section, low flap
ALBERT H ALDRIDGE—9 Cesarean section, Latzko, demonstration of modified technique and end results, with lantern slides, vaginal hysterectomy for uterine prolapse, Bissell technique
DR CARY—9 Treatment of sterility, demonstration of spermatozoa, motion pictures
NELSON B SACKETT—2 Abdominal hysterectomy for carcinoma of corpus uteri, postirradiation
GEORGE GRAY WARD—2 Insertion of radium for carcinoma of cervix, end results of treatment of gynecological cancer, demonstration of treated cases
HARRIET MCINTOSH—2 X-ray therapy for gynecological cancer

Friday

BELLEVUE HOSPITAL

- E W HOLLADAY—9 Operation Repair of cystocele and rectocele
HOWARD C TAYLOR, JR—9 Laparotomy for ovarian cyst, complete hysterectomy for carcinoma of corpus uteri
I WELLEN—9 Obstetrical ward rounds, toxemias of pregnancy
A REICH—9 Demonstration of Barton forceps

- DOALD BRACE—2 Collection of placental blood for in direct transfusions motion pictures
L S LOIZALY and staff—2 Advances in prenatal and postpartum care
JOHN L TRITSCH and staff—2 Demonstration of apparatus for collection and mensuration of postpartum blood Results obtained from the use of several oxytocics on postpartum bleeding

FRENCH HOSPITAL

- FREDERICK C HOLDEV and staff—9 Pre-operative preparation of gynecological cases nonoperative demonstration of LaForte operation for prolapse in elderly woman Kennedy hysterectomy through vagina—nonoperative discussion of extensive myomectomy with preservation of uterus in young woman presacral resection of nerves for dysmenorrhea bladder injuries in gynecological operations postoperative care of gynecological patients
F C HOLDEV H C FALK H C WILLIAMSON and staff—9 Gynecological and obstetrical operations in pecton of the new obstetrical hospital

HARLEM HOSPITAL

- HENRY C FALK, PETER M MURRAY and MURRY H LEVINE—9 Operations lecture on the tubal resection a new and simple procedure for recurrent gonorrheal salpingitis
JULIUS JARCHO—3 Demonstration of forceps operation with special reference to the axis traction

HOSPITAL FOR JOINT DISEASES

- ABRAHAM ROYCE and staff—2 Interposition and other gynecological operations
HOWARD E LYNDEMAN and staff—2 The Manchester and other gynecological operations

LENOX HILL HOSPITAL

- PERCY H WILLIAMS ROBERT L MCCREADY and staff—9 Operations

LYING IN HOSPITAL

- B H GOFF—9 Modified LaForte operation for complete prolapse operation for uterine prolapse
Staff—2 30 Symposium on urinary tract infection of pregnancy
HENRICUS J STANDER Relation of pyelitis to the toxemias of pregnancy
C M McLANE Follow up study of pyelitis of pregnancy
H F TRAUT Pyelonephritis as a complication of pyelitis of pregnancy
R C BENSON Postpartum and postoperative bladder retention and its treatment
ROBERT G DOUGLAS Mandelic acid and sulfanilamide therapy in the treatment of pyelitis complicating pregnancy
A A MARCHETTI The pyelitis ileus syndrome

MEMORIAL HOSPITAL

- WILLIAM F HEALY—9 Gynecological operations

MOUNT SINAI HOSPITAL

- SAMUEL H GRIST and staff—9 Ward rounds and dry clinic ovarian tumors pathological and clinical discussion with demonstration of specimens management of uterine bleeding
ROBERT T FRAK MORRIS A GOLDBERGER and PAUL KLEMPERER—2 Exhibit of endocrine methods of diagnosis and hormone studies of cases.

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

- GERARD L MOENCH—10 Influence of abnormalities of spermatozoa on sterility
WALTER T DANNEBERGER—2 Operations Supravaginal hysterectomy for uterine fibroids LaForte operation for complete prolapse, plaitation of the rectum and perineorrhaphy for enterocele tracheloplasty for chronic endocervicitis

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

- MALCOLM CAMPBELL—9 Gynecological operations.

PROSPYTERIAN HOSPITAL

(Sloane Hospital for Women)

- LEONARD F WATSON and staff—9 Operation Vaginal for cystocele and rectocele complete hysterectomy for cancer
JAMES A CORSCADEN—2 Cancer symposium
E S COLER and J H BOYD—3 30 Demonstration of pathological material

ROOSEVELT HOSPITAL

- HOWARD C TAYLOR THOMAS C FENWORTH HOWARD C TAYLOR JR and W E ALSOP—9 Operations Myomectomy radium or hysterectomy for fibroids radium or hysterectomy for postmenopausal bleeding

SYDENHAM HOSPITAL

- JULIUS JARCHO—9 Operations
ALFRED M HELLMAN—10 30 Operations Hysterectomy for fibroids and diseased adnexa cesarean sect on (low flap)
JULIUS JARCHO—2 Roentgenography as an aid in obstetrical diagnosis

WOMAN'S HOSPITAL

- EDWARD A BILLARD—9 Operation for complete laceration of sphincter ani (silver wire) Sturmdorf operation for chronic endocervicitis and end results.
GEORGE G BENTIS—9 Laparotomy for fibroids

Thursday

BELLEVUE HOSPITAL

- Staff—9 Dry Clines
ARTHUR REICH Value of ergotrate in reducing incidence of postpartum hemorrhage
SPENCER GLERNE Sulfanilamide therapy in gonorrheal infections of female
FRANCIS W SOVAK Operations for the relief of organic sterility in female demonstration of successful cases.
WM E STUBBINS Treatment of incomplete abortion complicated by fever
M GOLDBLATT and L LANGMAN Analysis of 343 cases operated upon for ectopic pregnancy
IRA I KAPLAN—2 Operation Application of radium for carcinoma of cervix
FRANCIS W SOVAK—2 Operation Reconstruction of fallopian tubes
DAVID A BARROWS—2 Operation Supravaginal hysterectomy for fibromyomata uteri

FLOWER FIFTH AVENUE HOSPITAL

- HENRY B SAFFORD and staff—9 Gynecological and obstetrical surgery

Thursday

MONTEFIORE HOSPITAL

IRA COHEN—2 Operations

MOUNT SINAI HOSPITAL

IRA COHEN and A KAPLAN—9 Operations

NEUROLOGICAL INSTITUTE

FRITZ CRAMER—9 30 Relative occurrence of convulsive seizures in depressed fractures of the skull—elevated and non-elevated

KATE CONSTABLE—9 30 Relative occurrence of convulsive seizures following concussion without cranial fracture

JOHN E. SCARFF—9 30 Cerebral scars in convulsive states and their treatment

NEW YORK HOSPITAL

GEORGE J HEUER and staff—2 Dry clinics Surgery of the nervous system

GEORGE J HEUER Surgery of the hypophysis
BRONSON S RAY Direct radiation of brain and spinal cord tumors on the operating table

HAROLD G WOLFF Headache

JOSEPH C HINSEY Visceral pain

N CHANDLER FOOT Tumors of the peripheral nerves

Friday

MOUNT SINAI HOSPITAL

IRA COHEN and A KAPLAN—9 Operations

NEUROLOGICAL INSTITUTE

CLEMENT MASSON—9 30 Tumors of the brain in children

BYRON STOOKEY—9 30 Tumors of the cord in children

FRACTURES AND TRAUMATIC SURGERY

Monday

HARLEM HOSPITAL

LOUIS T WRIGHT, RALPH H YOUNG, DAVID H SMITH, CALDWELL B ESSELSTYN, JESSE J GREENE, A ZINGARO, MAURICE C O'SHEA, FRANCIS L MORHARD, and THOMAS C CASE—3 15 Fracture symposium

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R MURRAY and staff—2 Dry clinic

Tuesday

BEEKMAN STREET HOSPITAL

Staff—9 Ward rounds and dry clinics

ROBERT H KENNEDY Fracture of shaft of the femur

JAMES H HEVL Fractures of the elbow

SIGMUND MAGE Compound fractures

LESTER BLUM Fractures of the shaft of the humerus

ROBERT T FINDLAY Conservative treatment versus immediate amputation in severe injuries of the hand and forearm

THOMAS M LOWRY Fractures of the scaphoid

MYRON A SALLICK Russell traction

BELLEVUE HOSPITAL

J GORDON LEE, HERBERT M BERGAMINI, ROBERT P WADHAMS, KENNETH M LEWIS, and GEORGE A KOENIG—12 30 Symposium on fractures, return clinic, ward rounds following clinic

FLOWER-FIFTH AVENUE HOSPITAL

MILTON J WILSON and staff—9 Demonstration of Russell traction and other fracture problems

MISERICORDIA HOSPITAL

SAMUEL B BURK—9 30 Operative and dry clinics

FRANCIS X TIMONEY—11 Diagnosis and treatment of fractures

NEW YORK CITY HOSPITAL

PRESTON WADR and BOARDMAN BOSWORTH—9 Operative and dry clinics

LAMAN W CROSSMAN, DAVID SLOANE, and CHARLES M GRATZ—9 Intrapelvic protrusion of the acetabulum (Otto pelvis), tendon transplantation for wrist drop

caused by posterior interosseous nerve paralysis following a compound fracture of the neck of the radius, cases illustrating various fractures of knee joint, traumatic dislocations, neurotrophic joints

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH, CLAY R MURRAY, and staff—9 Operations

WILLIAM DARRACH, CLAY R MURRAY, and staff—2 Follow-up clinic

ST VINCENT'S HOSPITAL

CONSTANTINE J MACGUIRE, JR—2. Injuries of the carpal bones, treatment

WILLIAM G DORAN—2 Healing of fractures with acute hematogenous osteomyelitis, immediate treatment of compound fractures, institutional treatment of fractures, treatment of compound dislocation of ankle joint

PRESTON A WADE—2 Fractures of the neck of the femur, comparison of results, Whitman abduction method with internal fixation

Thursday

COLUMBUS HOSPITAL

FILIPPO CASSOLA—9 30 X-ray traumatological exhibit

FRENCH HOSPITAL

SETH M MILLIKEN, ROBERT P WADHAMS, and associates—9 Traction suspension treatment of fractures of the clavicle, femur, tibia and fibula, skeletal traction versus skin traction in fractures, demonstration of Kirschner wire and Steinman pin, bilateral fracture of os calcis and fifth metatarsal treatment, treatment of fractured skulls, fracture dislocation of cervical vertebra, late reduction, refracture of tibia and fibula 18 months after repair with sliding graft, conservation of useful hand following traumatic avulsion of fingers and flexor tendons, rupture of liver with recovery, rupture of spleen with recovery, x-ray demonstration by Elmer M Claiborne

KNICKERBOCKER HOSPITAL

GEORGE A KOENIG, PHILIP D ALLEN, RICHARD J O'CONNELL, EDWARD R EASTON, D REES JENSEN, and WADE DULEY—1 Fracture of the shaft of the humerus in the

FLOWER FIFTH AVENUE HOSPITAL

HORACE AYERS and staff—9 Operations

HARLEM HOSPITALFREDERICK A KASSEBOHN JULIUS KUPFEROFF and A
CHARLES LOSVER—3 Emergency operative clinic**LENOX HILL HOSPITAL**ROBERT L MCCREADY PERCY H WILLIAMS and staffs—9
Operations**LINCOLN HOSPITAL**JOHN A KELLY—9 Treatment of carcinoma of cervix
and corpus uteri**LUTHERAN HOSPITAL**FREDERICK A KASSEBOHN—9 Emergency obstetrical
procedures**LYING-IN HOSPITAL**HERBERT F TRALT and ROBERT G DOUGLAS—9 Demon-
stration of the organization and operation of a cancer
follow up clinic**METROPOLITAN HOSPITAL**

HENRY B SAFFORD and staff—9 Operations

MOUNT SINAI HOSPITALLUDOR C RUBY and staff—9 30 Sterility clinic Mechan-
ical aspects of tubal insufflation motion pictures en-
docrine aspects in outpatient departmentSAMUEL H GEIST and staff—2 Some aspects of gynecolog-
ical urology**NEW YORK POST GRADUATE MEDICAL
SCHOOL AND HOSPITAL**THOMAS H CHERRY—9 Operations Anterior colpor-
rhaphy and perineorrhaphy vaginal hysterectomy for
uterine fibroids plastic repair of fallopian tubes for
sterility tracheloplasty for chronic endocervicitisWALTER T DANNEBERGER—10 Diagnosis of ectopic
pregnancy lantern slide demonstrationWALTER T DANNEBERGER—3 Operations Radium ap-
plication for carcinoma of the cervix oophorectomy for
ovarian tumor interposition operation for complete pro-
lapse supravaginal hysterectomy for uterine fibroidsI W KAHN and staff—3 Important urological conditions
in gynecological patients**NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL**DAVID N BARROWS—9 Gynecological operations
EDWARD H DENNEY—10 Obstetrical problems lect 7c**PRESBYTERIAN HOSPITAL**

(Sloane Hospital for Women)

B P WATSON and staff—9 Operations obstetrical rounds
obstetrical analgesia and anesthesia.RAFAEL FURZOK and associates—2 Symposium on
endocrine disturbances**ROOSEVELT HOSPITAL**HOWARD C TAYLOR THOMAS C PERMUTH HOWARD C
TAYLOR JR, and WILSON E ALSOP—9 Fothergill
operation on for uterine prolapse operation for endome-
triosis operation for chronic adnexal disease**ST FRANCIS' HOSPITAL**ALEXANDER NICOLL and staff—9 Hysterectomy, total
hysterectomy subtotal salpingectomy and suspension**ST VINCENT'S HOSPITAL**WILLIAM M FORD WALLACE KRUHLER JOHN F MC
GRATH JAMES P HENNESSY and JOSEPH E CORR—9
Operations**SYDENHAM HOSPITAL**JULIUS JACRO—2 Dry clinic Uterosalpingography—
visualization of the internal genitalia by means of injec-
tion of contrast media**WOMAN'S HOSPITAL**EDWARD A BULLARD—9 Operation for cystocele recto-
cele laceration of pelvic floorALBERT H ALDRIDGE—9 End results of spontaneous ver-
sus prophylactic methods of delivery with lantern
slidesJOSHUA W DAVIES—9 Operation for incontinence of
urine cystocele rectocele laceration of pelvic floorHARRIET MCINTOSH—9 X-ray perimetry Caldwell
Moloy technique

ARTHUR J MURPHY—2 Operation for fibroids

GEORGE GRAY VARD—2 Vaginal hysterectomy for uterine
prolapse Mayo techniqueDR WHITE—2 Diagnosis and treatment of intestinal ob-
struction in gynecological cases**NEUROSURGERY****Monday****NEUROLOGICAL INSTITUTE**

BYRON STOOKEY—1 Operation for brain tumor

**NEW YORK POLYCLINIC MEDICAL SCHOOL
AND HOSPITAL**

JOSEPH E J KING—2 30 Operations.

Tuesday**BELLEVUE HOSPITAL**

JOSEPH E J KING—1 Operations.

Staff—2 Symposium on neurological surgery

W D WINGEBACH Cases of brain and spinal cord
tumorsJOSEPH E J KING Demonstration of cases Brain
abscess osteomyelitis of the skull meningioma of the
middle fossaABRAHAM ARALEV Operation for meningioma of the
brain motion pictures cases of extradural and sub-
dural hematomataFRANK TURNER Case of subdural hygroma ventricu-
lography and encephalography Munro's tidal drain
age**NEUROLOGICAL INSTITUTE**CLARENCE HARE and GABRIEL SCHWARTZ—9 30 Car-
cinoma of the lung metastases to the brain

GEORGE HYSLOP—9 30 Thyroid metastases to the brain

BYRON STOOKEY—9 30 Neurosurgical measures for relief
of intractable pain due to metastatic carcinoma

SYDENHAM HOSPITAL

JACQUES W MALINIAC—3 Dry clinic

Friday

BELLEVUE HOSPITAL

YOLANDE H HUBER—9 30 Operations

YOLANDE H HUBER—2 Technique of dressings used for free transplants, moulages, cases demonstrating Wolfe grafts, cases of reconstruction for deformities following burns of face, hands and feet, demonstrating use of pedicled grafts, breast reconstructions, usual type, breast reconstructions with free nipple transplants, rhinoplasties and reconstructions for nasal defects, temporal muscle transplant for paralysis of the facial nerve, miscellaneous plastic and reconstructive cases, demonstrations with lantern slides and motion pictures, "side show," moulage, etc Operation Breast reconstruction

KNICKERBOCKER HOSPITAL

CLARENCE R STRAATSMA—9 Plastic operations on the face

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

CLARENCE R STRAATSMA and staff—9 Operative and dry clinics

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON, JR —2 Dry clinic Congenital and acquired deformities of nose, ears, lips, face, chin, body, extremities and pems, special conditions, including osteomyelitis, hemangiomas, keloids, pigmented moles, melanomata, Kaposi's disease, epitheliomata, fibrosarcomata, syphilis, lupus and tattoos

THORACIC SURGERY

Monday

BELLEVUE HOSPITAL

JAMES A MILLER, J BURNS AMBERSON, A V S LAMBERT and FRANK B BERRY—2 Symposium on diseases of the chest

FLOWER-FIFTH AVENUE HOSPITAL

SAMUEL THOMPSON—2 Operations

JOHN S O HERRLIN—2 Acute empyema

METROPOLITAN HOSPITAL

SAMUEL THOMPSON and staff—1 30 Operative and dry clinics

MONTEFIORE HOSPITAL

ARTHUR H AUFSER and ISIDOR KROSS—2 Operations

ST VINCENT'S HOSPITAL

FRANK MURRAY and DANIEL A MULVHILL—3 Treatment of lung abscess, medical and surgical aspects

Tuesday

MOUNT SINAI HOSPITAL

HAROLD NEUHOF, ARTHUR S W TOUROFF, and AMEIL GLASS—1 15 Operations

HAROLD NEUHOF, COLEMAN B RABIN, HERMAN HENNEL, DR BURLINER, AMEIL GLASS, and ARTHUR S W TOUROFF—1 15 Symposium on abscess of the lung Pathogenesis, pathology, clinical features, roentgenological features, localization, operative treatment, results of operation

NEW YORK CITY HOSPITAL

RICHMOND L MOORE and G H HUMPHREYS—9 Operative and dry clinics

LYMAN W CROSSMAN and staff—2 Surgical aspects of bronchiectasis, lantern slide demonstration with motion picture of a lobectomy in color

SYDENHAM HOSPITAL

ARTHUR S UNGER, MILTON FRIEDMAN, J TOWNSEND TRAVERS, SOLOMON FINEMAN, and DAVID E LHRICH—10 Symposium Diagnosis and treatment of lung tumors

Thursday

BELLEVUE HOSPITAL

A V S LAMBERT—9 30 Operations

LENOX HILL HOSPITAL

Staff—2 Symposium on non-tuberculous pulmonary suppuration.

H MCLEOD RIGGINS Etiology of bronchiectasis

GRANT THORBURN. Medical treatment of bronchiectasis

JOHN D KERNAN Bronchoscopic treatment of bronchiectasis

CARL EGGERS Surgical treatment of bronchiectasis

WM H STEWART Roentgen diagnosis and treatment of non-tuberculous intrapulmonary suppuration

GIRARD F OBERENDER The rôle of foreign bodies in the etiology of intrapulmonary suppuration

WALTER T STENSON The surgical treatment of lung abscess

GEORGE MUEHLECK Intrapulmonary suppuration complicated by empyema

OTTO C PICKHARDT The association of pulmonary suppuration with carcinoma of the lung

MEMORIAL HOSPITAL

Staff—2 Symposium on tumors of lung and mediastinum

LLOYD F CRAVER Diagnosis of interesting lung tumors

J SAMUEL BINKLEY Demonstration of the aspiration biopsy technique in lung tumors

EDWARD ELLIS Demonstration of the tumor material obtained by aspiration biopsy in lung tumors

METROPOLITAN HOSPITAL

SAMUEL A THOMPSON—1 30 Operations

NEW YORK HOSPITAL

GEORGE J HEUER and staff—9 Operative and dry clinics

GEORGE J HEUER Surgical treatment of pulmonary suppuration

WILLIAM DEW ANDRUS Surgery of mediastinal tumors

RALPH F BOWERS Acute and chronic empyema

CRANSTON W HOLMAN Scoliosis in intrathoracic disease

EDGAR MAYER Collapse therapy in pulmonary tuberculosis

aged follow up of fracture of the neck of the femur treated by internal fixation supracondylar fracture of the humerus in children compound comminuted fracture of the tibia and fibula dislocation of the femoral head anterior dislocation of the cervical vertebrae fracture of the lumbar vertebrae divergent fracture dislocation of the metatarsal bones

LENOX HILL HOSPITAL

Staff—9 Fracture Clinic

WALTER J GALLAND Ambulatory skeletal traction for overriding fractures of clavicle dislocations of the carpal semilunar bone 2 cases reduction with the aid of the Thomas wrench

JOHN C A GERSTER Open reduction of fractures

ALFRED F WIESENTHAL Fractures of the spine

HENRY JORDAN After care of fractures with special reference to brace treatment

SIMPLY GAYOR Ischial seat brace Lorenz osteoclast for treatment of fractures a cabinet for storing plaster of Paris bandages

Inspection of hospital brace shop

LINCOLN HOSPITAL

NESBY DWIGHT EDWARD D TRUESDELL JAMES R LINCOLN and JACOB FRIEDMAN—2 Symposium on fractures Ward rounds

METROPOLITAN HOSPITAL

MILTON J WILSON and staff—1 30 Russell traction treatment of compound fractures

MORRISANIA CITY HOSPITAL

EUGENE J BOESAN—9 30 Obscure traumatism of the hip joint

THOMAS I BRENNAN—9 30 Operations

THOMAS J O'KANE and FREDERICK H WILLIAMS—11 Diabetic surgery of the extremities

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

HERRBERT M BERGMANN and EMMETT A DOOLEY—2 Operative and dry clinics Fractures of the neck of the femur (At Reconstruction Hospital)

JOHN J MOORHEAD—2 Operations

H H RITTER—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID M BOSWORTH—10 Operative and dry clinics

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH CLAY R MURRAY and staff—9 Operations

WILLIAM DARRACH CLAY R MURRAY and staff—1 Traction clinic

UNITED STATES MARINE HOSPITAL

E C STAYN and staff—10 30 Symposium on fractures of the jaw

F LIBERSON and S P COOPER—2 Symposium Shoulder injuries x ray aspects and follow up clinics

Staff—2 Symposium on head injuries

HAROLD KELMAN Neurological aspects

L A PALMER and staff Surgical aspects

Friday

BEEKMAN STREET HOSPITAL

Staff—9 Ward rounds and dry clinics

ROBERT H KENNEDY Fracture of shaft of the femur

JAMES H HEYL Fracture of the elbow

SIGMUND MACE Compound fractures

LESTER BLUM Fractures of the shaft of the humerus

ROBERT T FINDLAY Conservative treatment versus immediate amputation in severe injuries of the hand and forearm

THOMAS M LOWRY Fractures of the scapula

MYRON A SALICK Russell traction

FLOWER FIFTH AVENUE HOSPITAL

MILTON J WILSON and staff—9 Treatment of compound fractures demonstrations of end results

PRESBYTERIAN HOSPITAL

WILLIAM DARRACH CLAY R MURRAY and staff—9 Fracture conference

PLASTIC AND FACIOMAXILLARY SURGERY

Tuesday

LINCOLN HOSPITAL

GUSTAV ALFRIED and JACOB FRIEDMAN—2 Operative and dry clinics

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

GUSTAV ALFRIED and staff—9 Operative and dry clinics

FRED SQUIER DUNN—10 30 Operations

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON JR—9 Operations

SIDENHAM HOSPITAL

TREODOR BLUM—10 Ameloblastoma from the clinical x ray and pathologic standpoint with presentation of cases

JACQUES H MALINJAC—1 30 Operations

Thursday

BETH ISRAEL HOSPITAL

ARTHUR J BARSKY—9 Operations

LUTHERAN HOSPITAL

KEITH KAHN—2 Operations

NEW YORK CITY HOSPITAL

ALEXANDER ZIMANY—9 Operative and dry clinics

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

HAROLD S VAUGHAN and staff—11 Operations

PRESBYTERIAN HOSPITAL

JEROME P WEBSTER and THOMAS W STEVENSON JR—9 Operations

HENRY S DUNNING—2 Operations Harelip cleft palate bone graft of mandible ankylosis of temporo-mandibular joint

LOUIS SALTZMAN Operative removal of free bodies in peroneal tendon sheath
 ADOLPH A SCHMIER Fracture dislocation of the elbow—2 cases—one with median nerve involvement and one with ulnar nerve involvement
 ISADORE ZADEK and staff—2. Operations Horizontal wedge arthrodesis for flat foot

MONTEFIORE HOSPITAL

SETH SELIG—10 Dry clinic Diagnosis and treatment of unsuspected adrenal insufficiency in bone tuberculosis
 ROBERT K LIPPMAN—10 Dry clinic Bone tuberculosis

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on scoliosis
 ALAN DEF SMITH Routine treatment, organization of special clinic, criteria for selection of patients for operation, compensation
 ALBERT B FERGUSON Measurement of the curve, identification of primary curve, determination of area for operation
 McDOWELL ANDERSON The jacket, principles, application and preparation for operation, semi-bent and straight jacket
 BENJAMIN P FARRELL Spine fusion operation technique
 ALAN DEF SMITH Results of operative treatment
 GEORGE L INGE—1 30 Scoliosis clinic Demonstration of cases before and after operation

HOSPITAL FOR RUPTURED AND CRIPPLED

PHILIP D WILSON and EARL E VAN DERWERKER—9 Ward rounds, children's orthopedic service
 Staff—10 End result clinic
 Staff—10 30 Regular weekly orthopedic staff meeting, with service reports from house surgeons
 RAYMOND W LEWIS X-ray reports
 DOMINIC A DESANTO Interesting pathological specimens
 BRADLEY L COLEY, NORMAN L HIGINBOTHAM, and DOMINIC A DESANTO—2 Discussion of problems in diagnosis and treatment of bone tumors

ST LUKE'S HOSPITAL

MATHER CLEVELAND and DAVID M BOSWORTH—2 Operative and dry clinics Tibial distraction, treatment of fracture of the neck of the femur

Thursday

BELLEVUE HOSPITAL

ARTHUR KRIDA and staff—2 Symposium on orthopedic surgery Intracapsular fracture of neck of the femur, bone peg operation, epiphyseal fracture of the neck of the femur, bone peg operation, congenital dislocation of the hip, genu recurvatum operation, cruciate ligament repair, encircling fascial band operation for splay foot and hallux valgus, congenital absence of tibia, Charcot's knees, fusion operation, modified reconstruction of the hip for osteo-arthritis

FLOWER-FIFTH AVENUE HOSPITAL

A H BINGHAM and staff—9 Problems in orthopedic surgery, demonstration of cases, illustrated by motion pictures and lantern slides

GOVERNEUR HOSPITAL

WALTER D LUDLUM, JR., JOHN P STUMP, and staffs—2 Presentation of cases from orthopedic and traumatic services

JOHN P STUMP Fracture of the femoral neck, conservative treatment, three cases Flexion-adduction deformity of hip, operative correction

SYDNEY NARINS Lumbar puncture needle injury of an intervertebral disc

WALTER D LUDLUM, JR Slipped capital femoral epiphysis, open reduction, two cases

MILES C. KREPPELA Fracture of shaft of humerus, traction-suspension treatment, three cases

CARL A PETERSON Head injuries with visual disturbances, two cases

DANTE P DAPOLONIA Fractured femur in children, Russell traction treatment, three cases

HOSPITAL FOR JOINT DISEASES

SAMUEL A JAHSS and staff—9 Operations
 HARRY FINKELSTEIN and staff—9 Operations Leg lengthening, stenosing tendovaginitis, correction of rachitic deformities, new operation for hallux valgus, reduction of epiphyseolysis of the hip
 SAMUEL A JAHSS and staff—2 Dry clinic

MOUNT SINAI HOSPITAL

Staff—9 Operative and dry clinics
 SETH SELIG Fixation of osteo-arthritis of the hip joint by Smith-Petersen nail
 ROBERT LIPPMAN Internal fixation of intracapsular fracture of the neck of the femur by the corkscrew bolt
 EDGAR M BICK Immediate results in pathological fractures
 ALBERT J SCHEIN End results of hemiphalangectomy for hallux valgus

NEW YORK ORTHOPAEDIC HOSPITAL

Staff—9 Symposium on tuberculosis of joints
 WALKER E SWIFT Pathology and diagnosis
 ALAN DEF SMITH Treatments, general consideration and reasons for operative treatment
 Demonstration of patients illustrating end results
 WILLIAM H VON LACKUM Spine
 HALFORD HALLOCK Hip, elbow
 GEORGE L INGE Knee
 LEONIDAS A LANTZOUNIS Ankle
 M BECKETT HOWORTH Shoulder
 FREDERICK L LIEBOLT Wrist
 GEORGE L INGE—1 30 Outpatient clinic, general orthopedic conditions
 MALCOLM B COUTTS—1 30 Club feet.

RIVERSIDE HOSPITAL

HENRY MILCH—10 Bone complications in advanced pulmonary tuberculosis

HOSPITAL FOR RUPTURED AND CRIPPLED

Staff—2 Presentation of orthopedic problems
 RUFUS H ALLDREDGE Localized osteitis fibrosa cystica
 RICHMOND STEPHENS Operative treatment of flat feet
 JOHN R COBB Scoliosis
 ERNEST E MYERS Low back pain
 T CAMPBELL THOMPSON Epiphysiodesis
 PHILIP D WILSON Elbow fractures, carpal injuries
 LEWIS C WAGNER Tendon transplantation for paralytic wrist drop
 FRANCIS CARR Fractures of the lower end of the femur.
 T CAMPBELL THOMPSON Presentation of cases for operation Friday morning

UNITED STATES MARINE HOSPITAL

W G DORAN—2 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

LOUIS R. DAVIDSON— Operative and dry clinics

PRESBYTERIAN HOSPITAL

RICHMOND L. MOORE D. W. RICHARDS JR. BYRON STOOKEY ROSS GOLDBY and JOHN D. KERNAN—2 Symposium on tumors of the lung

Friday

LENOX HILL HOSPITAL

Staff—2 Symposium on surgical treatment of pulmonary tuberculosis.

GRANT THORBURN Indications for collapse therapy

PHILIP G. C. BISHOP Pneumothorax

HERBERT C. MAIER Intrapleural pneumolysis

WALTER T. STENSON Possible pitfalls in phrenic nerve crushing

HERBERT W. MAYER Results of surgical treatment of pulmonary tuberculosis at Lenox Hill Hospital during the last twenty years

OTTO C. PICKHARDT Extrapleural thoracoplasty

H. McLEOD RIGGINS Tuberculous empyema—medical treatment

CARL EGGERS Tuberculous empyema—surgical treatment

JOHN D. KERNAN GIRARD OBERENDER and H. McLEOD RIGGINS Tuberculosis of the bronchi

WILLIAM H. STEWART Cinefluorographic demonstration of respiration Breathing in normal cases breathing in patients with pulmonary tuberculosis, breathing

in patients after phrenic crushing breathing in patients with pneumothorax breathing in patients after extrapleural thoracoplasty

RIVERSIDE HOSPITAL

LOUIS CARP—9 Operations Phrenicectomy pneumolysis thoracoplasty

LOUIS CARP and staff—2 Dry clinics

LOUIS CARP Cold abscess of chest wall thoracotomy and contra indications for pneumolysis.

ARTHUR H. AUFSER Indications for thoracoplasty

JEROME M. ZIEGLER The management of tuberculous empyema

BORRIS A. KORNBLITH Follow up results in phrenic emphysema

MAX TASCHMAN Demonstration of pneumothorax and its complications

ROOSEVELT HOSPITAL

FRANK B. BERRY—9 Lobectomy and thoracoplasty

ST LUKE'S HOSPITAL

A. E. W. ADA and associates—9 Operative and dry clinics

P. G. C. BISHOP Selective bronchography

S. T. ALLISON Diseases of the mediastinum

O. R. JONES Pneumothorax therapy for tuberculosis during pregnancy

L. C. KNOX Pathology of primary carcinoma of the lung

A. E. W. ADA Surgical treatment of acute abscess of the lung

SURGERY OF THE BONES AND JOINTS

Monday

BELLEVUE HOSPITAL

ARTHUR F. REIDA—2 Operations

HOSPITAL FOR JOINT DISEASES

HARRY FINKELSTEIN and staff—2 Dry clinic Cases of leg lengthening rachitic deformities treated by decalcination method tenosynovitis epiphyseolysis

of the hip synostosis operation for ununited fractures of the tibia and fibula cases of hallux valgus (new operation) cases of subtrochanteric osteotomy by the inverted L procedure low back lesions venography for muscle angioma glomus tumors

METROPOLITAN HOSPITAL

ANSON H. BINGHAM and staff—1 30 Operative and dry clinics

MISERICORDIA HOSPITAL

CASTON A. CARLUCCI—2 Osteomyelitis—the surgical problem

NEW YORK ORTHOPAEDIC HOSPITAL

HALFORD HALLOCK—1 30 General clinic including all orthopedic conditions

Tuesday

HOSPITAL FOR JOINT DISEASES

LEO MAYER and staff—9 Dry clinic

LEO MAYER Cases illustrating reconstructive tendon surgery

NICHOLAS S. RANSOHOFF Abdominal fascial transplants for abdominal paralysis

BENJAMIN WOLFPORT Adamantinoma of the tibia
JOSEPH MILLGRAM The aspiration therapy of subacromial bursitis

DANIEL TELSON Fractures of the neck of the femur treated by wiring

HARRY D. SONNENSCHN and staff—2 Dry clinic

HARRY D. SONNENSCHN Two cases of resection of the elbow joint lipoid granulomatosis of ribs and sacrum

MICHAEL S. BURMAN Complete cordylar fracture of the humerus in an adult operative removal of displaced condyles

fourriquet paralysis of lower extremity following knee operation operative release of sciatic nerve

two cases of fracture of posterior arch of atlas

JOSEPH G. WISNER Two cases of congenital dislocation of hips diagnosed soon after birth subcutaneous drilling for the relief of pain in osteoarthritis of the hip after old slipped epiphysis of the upper femoral epiphysis

MARK M. LOUWANS Three cases of giant cell tumor of the spine

ABRAHAM KENIN Case of scoliosis treated by wedged turnbuckle jacket and two-stage spine fusion operation case of Scheuermann's disease of the spine case of narrowed intervertebral disc between L5 and S1

SALL RITCHIE A complicated wrist fracture—commuted Colles fracture fracture of the scaphoid and fracture with displacement of the os magnum operative removal of displaced head fracture of the neck of the femur in a child slipped upper femoral epiphysis fracture of the neck of the femur in reduction and result.

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

MAX HALLE—1 Lecture
WILLIAM L GATEWOOD—2 Operations

Tuesday

BELLEVUE HOSPITAL

J WINSTON FOWLKES—2 Operations

BETH ISRAEL HOSPITAL

SAMUEL J KOPETZKY and staff—2 Operations

FLOWER-FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Operations and demonstrations of interesting cases Motion pictures

HARLEM EYE AND EAR HOSPITAL

ALEXANDER LASZLO—2 Operations and demonstrations of cases

HARLEM HOSPITAL

HERMAN J BURMAN and staff—1 30 Endoscopic demonstrations

HERMAN J BURMAN, MAX MARSH, MARK GOTTLIEB, and MICHAEL ROSENBLUTH—1 30 Operative and dry clinics

LENOX HILL HOSPITAL

JOHN D KERNAN and staff—9 Bronchoscopic clinic
JOHN D KERNAN, GIRARD OBERRENDER, and staff—2. Operations

LINCOLN HOSPITAL

WILLIAM H HOLDEN, MURRAY BERGER, and HAROLD LIGGETT—2 Operative and dry clinics

MANHATTAN EYE, EAR AND THROAT HOSPITAL

ROBERT E BUCKLEY, A S WILSON, and staff—9 and 2 Rhinological clinics

JOHN R PAGE, R H HUVELL, and staff—9 and 2 Otolological clinics

DAVID H JONES and JOHN M LORE—2 Endoscopic demonstration

METROPOLITAN HOSPITAL

J A W HETRICK and staff—1 30 Tonsil surgery in children

MOUNT SINAI HOSPITAL

JACOB L MAYBAUM, WALTER L HORN, SAMUEL ROSEN, JOSEPH G DRUSS, HARRY ROSENWASSER, and EUGENE R SNYDER—10 Operative and dry clinics, intracranial complications of otitic origin, recovered cases of streptococcus meningitis, petrositis, sepsis of otitic origin, value of sulfanilamide in otological conditions, neuro-otological cases, histopathological studies

RUDOLPH KRAMER and staff—2 Operative and dry clinics

NEW YORK CITY HOSPITAL

OTTO C RISCH and staff—2 Operative and dry clinics
HILTON H STOTHERS—2 Bronchoscopic clinic

NEW YORK EYE AND EAR INFIRMARY

J C HANLEY—10 Operations and demonstration of interesting cases
F C CARR and W C DENISON—2 Operations

NEW YORK HOSPITAL

Staff—2 Exhibits and demonstrations in outpatient department, pavilion rounds

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

DAVID H JONES—9 Bronchoscopy, lecture and demonstration

JULIUS I KLEPPER—11 Cadaver demonstration

RALPH ALMOUR—1 Cadaver demonstration

SAMUEL J KOPETZKY—2 Cadaver demonstration

PRESBYTERIAN HOSPITAL

JAMES W BABCOCK—2 Operations

RIVERSIDE HOSPITAL

GEORGE D WOLF and DAVID I FRANK—10 Operations
Direct laryngoscopy and cauterization of larynx Dry clinic Tuberculous laryngitis in various stages

ROOSEVELT HOSPITAL

CHARLES N HARPER and staff—2 Bronchoscopic clinic

ST FRANCIS' HOSPITAL

HENRY J DILLEMUTH and staff—2 Operations and demonstrations of cases

ST VINCENT'S HOSPITAL

JOHN M LORE and staff—2 Presentation of cases Stripping of vocal cords, laryngofissure for carcinoma, laryngectomy, laryngeal stenosis, subglottic tumor in a child, cases for diagnosis Lantern slide talks Technique of stripping of vocal cords, Lore modification of laryngofissure operation, operative procedure for relief of double abductor paralysis

ANTHONY ROTTINO—2 Pathological demonstration

Thursday

BELLEVUE HOSPITAL

J WINSTON FOWLKES and staff—2 Dry clinic Postoperative petrositis, motion pictures of radical frontal sinus operation

FLOWER-FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Demonstrations of interesting cases

HARLEM EYE AND EAR HOSPITAL

ALEXANDER LASZLO—2 Mastoid operations

HOSPITAL FOR JOINT DISEASES

JULIUS A HAIMAN and staff—9 Dry clinics

JULIUS A HAIMAN and staff—2 Operations

LENOX HILL HOSPITAL

GIRARD OBERRENDER and staff—9 Bronchoscopic clinic

MANHATTAN EYE, EAR AND THROAT HOSPITAL

JOSEPH D KELLY, C W DEPPING, and staff—9 and 2 Otolological clinics

FRANCIS W WHITE, J D WHITHAM, and staff—9 and 2 Rhinological clinics

MORRISANIA CITY HOSPITAL

CLARENCE H SMITH—2 Operations Mastoid

NEW YORK CITY HOSPITAL

HAROLD B JUDD—2 Operative and dry clinics

VETERANS ADMINISTRATION HOSPITAL

- T F CARROLL—12 45 Demonstrations Artificial limb assembly modified and improved braces fabricated jackets and supports, orthopedic shoes
- CHARLES F BLOOM—12 45 Roentgenological equipment presentation of x ray material films and lantern slides of current cases and others of particular interest to the general surgeon and cancer specialist
- C R BROOKE—12 45 Physical therapy department newer modalities of particular interest to the surgeon

Friday

GOUVERNEUR HOSPITAL

- WALTER D LUDLUM JR JOHN I STUMP and staffs—9 Presentation of cases from orthopedic and traumatic services
- CARL A PETERSON Fractured femur with sciatic nerve injury
- DR CLUG Fractures of the jaw two cases
- WALTER D LUDLUM JR Selective reurectomy Incidence of open correction of fresh fractures
- DANTE P DAPOLONIA and MILES C KREFELA Fracture of the humeral epicondyles open reduction two cases
- JOHN P STUMP Painful knees due to faulty posture with illustrations Maintaining reduction of oblique fractures with ambulatory Kirschner wire spreaders
- MILES C KREFELA Fracture of the tibial condyles three cases
- ABRAHAM A KATZ Club feet conservative treatment two cases

HOSPITAL FOR JOINT DISEASES

- SAMUEL KLEINBERG JOSEPH BUCHMAN and staff—9 Dry clinics
- SAMUEL KLEINBERG Cases of chronic slipped femoral epiphysis treated by open operation cases of arthroplasty of the hip and knee
- JOSEPH BUCHMAN Cases of chronic osteomyelitis under maggot treatment case of Perthes disease complicated rickets
- JOSEPH BUCHMAN and HERMAN LIEBERMAN Cases of syphilis of bones and joints

M HERZMARK Case of perosteal fibrosarcoma of the lower end of the femur six years postoperative no recurrence no amputation

HERMAN LIEBERMAN Cases of club feet treated by manual correction

R R GOLDBERG Case of Perthes disease complicated in a dislocation of the hip

F I SCHWARTZBERG Cases of osteochondritis of the ischiopubic region

SAMUEL KLEINBERG JOSEPH BUCHMAN and staff—9 Operations Arthroplasty, slipped femoral epiphysis

Perthes disease osteomyelitis

LEO MAYER and staff—2 Operations Reconstructive tendon surgery

LINCOLN HOSPITAL

ARMITAGE WHITMAN—9 Operative and dry clinic

NEW YORK ORTHOPAEDIC HOSPITAL

BENJAMIN P FARRELL and staff—9 Operations

BENJAMIN P FARRELL—1 30 Outpatient clinic general orthopedic conditions

HOSPITAL FOR RUPTURED AND CRIPPLED

- PHILIP D WILSON and staff—9 Operations
- Staff—11 Presentation of orthopedic problems
- LEWIS C WAGNER High osteotomy for lesions of the hip
- PHILIP D WILSON Slipped femoral epiphysis
- T CAMPBELL THOMPSON Stabilization of equinus foot
- RAYMOND W LEWIS and WALTER GRAHAM Secondary osteo arthritis following fractures of the ankle
- LEWIS CLARK WAGNER Elastic operation for recurrent dislocation of the patella
- JOHN R COBB Fractures of surgical neck of the humerus
- KRISTIAN D HANSSON Paralysis of the serratus magnus

SYDENHAM HOSPITAL

HARRY D SONNENSCHEIN JOSEPH G WISNER MARK M YOUNG and ADOLPH A SCHMER—9 Dry clinic

Fractures of shoulder wrist and elbow

OTOLARYNGOLOGY

Monday

FLOWER FIFTH AVENUE HOSPITAL

- J A W HETRICK and staff—2 Operations and demonstrations of interesting cases Mastoid operations
- M S LLOYD—2 Bronchoscopic demonstrations
- Motion pictures and exhibits in Trustees Room

HARLEM EYE AND EAR HOSPITAL

- CHARLES B MEDING—9 Tonsil operation
- ALBERT HETHERINGTON and I HENRY ALEXANDER—2 Demonstrations of cases

LUTHERAN HOSPITAL

CHARLES C FRANCIS and staff—2 Operations

MANHATTAN EYE EAR AND THROAT HOSPITAL

- JAMES G DWYER C M GRIFFITH and staff—2 Otolological operations
- DAVID H JONES O L MONROE and staff—2 Rhinological operations

MONTEFIORE HOSPITAL

A A SCHWARTZ—2 Dry clinic Laryngeal tuberculosis

MORRISANIA CITY HOSPITAL

G B GILMORE and staff—2 Demonstration of interesting cases

NEW YORK HOSPITAL

- ARTHUR PALMER and staff—2 Operative and dry clinics
- ALFRED F HOCKEY Upper respiratory carcinoma
- ARTHUR PALMER Laryngeal stenosis
- L MILES ATKINSON Vertigo (aural)
- SAMUEL F KELLEY Sinusitis in allergic cases
- GERVAIS W McCLIFFE Demonstration of teaching models

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

ARTHUR NILSEN and staff—2 Operations

HARLEM EYE AND EAR HOSPITAL

CHARLES B MEDING and ARCHIE OBERDORFER—2
Operations and demonstrations of cases

HARLEM HOSPITAL

PAUL A COLLINS—2 Fundus operations and ward rounds

KNAPP MEMORIAL EYE HOSPITAL

ARNOLD KNAPP and staff—9 Operative and dry clinics

MANHATTAN EYE, EAR AND THROAT HOSPITAL

PLINEUS H MONTALVAN—9 Follow-up clinic on glaucoma
McCLELLAND SHELLMAN—9 Fundus clinic
H ROBERTSON SKEEL and staff—2 Operations

METROPOLITAN HOSPITAL

A L CHAMBERS and staff—1 30 Fundus clinic, external diseases of the eye

MONTEFIORE HOSPITAL

SIGMUND A AGATSTON—9 Dry clinic

NEW YORK EYE AND EAR INFIRMARY

E B BURCHELL—9 30 The laboratory and its aid to ophthalmology
IRVING SCHWARTS—10 30 X-ray of accessory sinuses and skull, fundamentals
WILLIS S KNIGHTON—11 30 Contact lenses
SAMUEL P OAST and staff—2 Operations Cataracts, modified LaGrange, general
BERNARD SAMUELS and staff—2 Operative and dry clinics

NEW YORK HOSPITAL

Staff—2 Exhibit of rare old English, American, German and French books on ophthalmology, interesting clinical cases

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

CLYDE E McDANNAID—3 Operations

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinics

PRESBYTERIAN HOSPITAL
(Institute of Ophthalmology)

JOHN M WHEELER and staff—9 30 Operative and dry clinics

UNITED STATES MARINE HOSPITAL

W P. GRIFFEY and RUDOLPH AEBLI—2 Operative and dry clinic

Thursday

BETH ISRAEL HOSPITAL

WEBB W WEEKS—2 30 Operations

COLUMBUS HOSPITAL

GIROLAMO BONACCOLTO—9 30 Exhibit of slit lamp cases and operations

HARLEM EYE AND EAR HOSPITAL

JOHN J DECKER, MAX GOLDSCHMIDT, and LOUIS SCHWARTS—2 Operations and demonstrations of cases

HARLEM HOSPITAL

HENRY MINSKY—2 Operative and dry clinics, Lid injuries

LENOX HILL HOSPITAL

E F KRUG, J J REID, JR and staff—2 Operations

MANHATTAN EYE, EAR AND THROAT HOSPITAL

PLINEUS H MONTALVAN—9 Demonstration of contact glasses and telescopic lenses
ANDREW A EGGSTON and JOSEPH LAVAL—9 Demonstrations of eye pathology
NORTON DEL FLETCHER and staff—2 Operations

MOUNT SINAI HOSPITAL

KAUFMAN SCHLIVEK and staff—9 Cataract extraction, trephine, LaGrange, Safar for detachment, ptosis-advancement of levator

NEW YORK EYE AND EAR INFIRMARY

CONRAD BERENS and staff—9 Operations Iridocorneo-sclerectomy, retropacements, Tenon's capsule transplant, iridocapsulotomy, general operations
WEBB W WEEKS and staff—2 Operations Intracapsular cataracts, modified LaGrange, muscle operations
WENDELL L HUGHES—2 Plastic, corneal transplant

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinic

PRESBYTERIAN HOSPITAL
(Institute of Ophthalmology)

JOHN A DUNNINGTON, THOMAS H JOHNSON, DANIEL B KIRBY, and ALGERNON B REESE—9 30 Operative and dry clinics

Friday

BELLEVUE HOSPITAL

WEBB W WEEKS and staff—2 Demonstrations of post-operative cases, illustrated with results from operations for cataract, glaucoma and plastic surgery of the eye and orbit

HARLEM EYE AND EAR HOSPITAL

CHARLES B MEDING and staff—2 Operations and demonstrations of cases

HOSPITAL FOR JOINT DISEASES

DAVID WEXLER and staff—2 Dry clinic
MAURICE POMERANZ and HENRY K TAYLOR—2 Planigraphy in orthopedic surgery

MANHATTAN EYE, EAR AND THROAT HOSPITAL

R TOWNLEY PATON—9 Demonstration of cornea transplanting and ophthalmic photography
GIROLAMO BONACCOLTO—9 Slit lamp demonstration
DAVID H WEBSTER and staff—2 Operations

PRESBYTERIAN HOSPITAL
(Institute of Ophthalmology)

JOHN A DUNNINGTON, THOMAS H JOHNSON, DANIEL B KIRBY, and ALGERNON B REESE—9 30 Operative and dry clinics

ST LUKE'S HOSPITAL

W GUERNSEY FREY, JR and staff—2 Operative and dry clinics

H T SMITH The Laurence-Moon-Biedl syndrome
WALTER HIPF Treatment of conjunctivitis with bacteriophage

NEW YORK EYE AND EAR INFIRMARY

EDGAR BURCHELL—10 Dry clinic Surgical anatomy of the temporal bone and its variations
J M SMITH—10 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

ARTHUR NILSEN and staff—2 Operations

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

HENRY B ORTOW—9 Cadaver demonstration
J LASTMAN SHEERAN—11 Lecture on otolaryngology and plastic surgery
W WALLACE MORRISON—1 Lecture
LEE M HURD—2 Operations
H G BULLWINKEL—3 Cadaver demonstration bronchoscopy

PRESBYTERIAN HOSPITAL

GEORGE R. BRIGHTON—1 Bronchoscopic clinic Presentation of cases demonstration of technique of bronchospirometry

ROOSEVELT HOSPITAL

CHARLES N HARPER and R C GROVE—2 Dry clinic.

ST LUKE'S HOSPITAL

WESLEY C BOWERS and staff—3 Operative and dry clinics Meningeal infections of otologic origin sinus infections and their treatment

UNITED STATES MARINE HOSPITAL

W P GRIFFEY A J HLEY and staffs—2 Operations

Friday

FLOWER FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Operations and demonstrations of interesting cases motion pictures

HARLEM EYE AND EAR HOSPITAL

JOHN J LEVY—9 Voice and speech clinic
Staff—2 Operations and demonstrations of cases

OPHTHALMOLOGY

Monday

HARLEM EYE AND EAR HOSPITAL

HARVEY LYON—2 Refraction clinic

MANHATTAN EYE EAR AND THROAT HOSPITAL

FRANK C KEIL and staff—2 Operations

MORRISANIA CITY HOSPITAL

JOSEPH S HORY and staff—2 Operations for cataract glaucoma and squint interesting eye conditions in relation to general medicine

NEW YORK EYE AND EAR INFIRMARY

CLYDE E McDANNAID and staff—2 Operations Cataracts muscle ptosis
TRUMAN L BOYES—4 Surgical treatment of ocular muscle anomalies with demonstrations of cases

NEW YORK HOSPITAL

Staff—2 Dry clinics

HARLEM HOSPITAL

HERMAN J BORMAN NATHANIEL HALPERN and CHARLES HARRIS—9 Tonsil clinic Snarestone and dissection operations

MANHATTAN EYE EAR AND THROAT HOSPITAL

MARVIN F JONES D S CUNNING T G TUCKLE and staff—9 and 2 Otolological clinics
E ROSS FAULKNER WESLEY M HUNT and staff—9 and 2 Rhinolaryngological clinics
DAVID H JONES and JOHN M LORE—2 Endoscopic demonstration

METROPOLITAN HOSPITAL

J A W HETRICK and Staff—1 30 Operative and dry clinics

MORRISANIA CITY HOSPITAL

G B GILMORE HENRY J DILLEMUTH and JOSEPH LASALA—2 Bronchoscopic clinic

MOUNT SINAI HOSPITAL

RUDOLPH KRAMER and Staff—2 Operative and dry clinics

NEW YORK EYE AND EAR INFIRMARY

T L SAUNDERS—10 Demonstration of interesting ear and sinus cases operations
STUART L CRAIG—2 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

PAUL S SEAGER—2 Laryngeal surgery cadaver
CHARLES M GRIFFITH—2 Sinus surgery cadaver
JAMES O MACDONALD—2 Mastoid surgery cadaver

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

M COLEMAN HARRIS—9 Allergy in otolaryngology
NATHAN SEITZEL—10 Lecture
THOMAS G TICKLE—11 Cadaver demonstration of facial palsy
MALCOLM W CARR—1 Oral surgery in otolaryngology
CHARLES J IMPERATORI—2 Operations
M H KATZEN—3 Lecture

BERNARD SAMUELS Intra-ocular tumors lecture illustrated with anatomical preparations Demonstration of anatomical specimens and teaching models
MILTON L BERLINER Slit lamp demonstration
N BLAIR SLOOFF Practical points in refraction

NEW YORK CITY HOSPITAL

RAYMOND E MEKE and FRANK C KEIL—2 Operative and dry clinics

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

ERVIN TOROK—3 Operations

RIVERSIDE HOSPITAL

CLIFFORD W ELLISON—3 Eye conditions in tuberculous patients

Tuesday

BELLEVUE HOSPITAL

WERNER W WEEKS and staff—2 Operations for cataract, glaucoma and squint

HARLEM EYE AND EAR HOSPITAL

CHARLES B MEDING and ARCHIE OBERDORFER—2
Operations and demonstrations of cases

HARLEM HOSPITAL

PAUL A COLLINS—2 Fundus operations and ward rounds

KNAPP MEMORIAL EYE HOSPITAL

ARNOLD KNAPP and staff—9 Operative and dry clinics

MANHATTAN EYE, EAR AND THROAT HOSPITAL

PLINEUS H MONTALVAN—9 Follow-up clinic on glaucoma

MCCLELLAND SHELLMAN—9 Fundus clinic

H ROBERTSON SKEEL and staff—2 Operations

METROPOLITAN HOSPITAL

A L CHAMBERS and staff—1 30 Fundus clinic, external diseases of the eye

MONTEFIORE HOSPITAL

SIGMUND A AGATSTON—9 Dry clinic

NEW YORK EYE AND EAR INFIRMARY

E B BURCHELL—9 30 The laboratory and its aid to ophthalmology

IRVING SCHWARTS—10 30 X-ray of accessory sinuses and skull, fundamentals

WILLIS S KNIGHTON—11 30 Contact lenses

SAMUEL P OAST and staff—2 Operations Cataracts, modified LaGrange, general

BERNARD SAMUELS and staff—2 Operative and dry clinics

NEW YORK HOSPITAL

Staff—2 Exhibit of rare old English, American, German and French books on ophthalmology, interesting clinical cases

NEW YORK POLYCLINIC MEDICAL SCHOOL AND HOSPITAL

CLYDE E McDANNALD—3 Operations

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinics

PRESBYTERIAN HOSPITAL

(Institute of Ophthalmology)

JOHN M WHEELER and staff—9 30 Operative and dry clinics

UNITED STATES MARINE HOSPITAL

W P GRIFFEY and RUDOLPH AEBLI—2 Operative and dry clinic

Thursday

BETH ISRAEL HOSPITAL

WEBB W WEEKS—2 30 Operations

COLUMBUS HOSPITAL

GIROLAMO BONACCOLTO—9 30 Exhibit of slit lamp cases and operations

HARLEM EYE AND EAR HOSPITAL

JOHN J DICKER, MAX GOLDSCHMIDT, and LOUIS SCHWARTS—2 Operations and demonstrations of cases

HARLEM HOSPITAL

HENRY MINSKY—2 Operative and dry clinics, Lid injuries

LENOX HILL HOSPITAL

E F KRUG, J J REID, JR and staff—2 Operations

MANHATTAN EYE, EAR AND THROAT HOSPITAL

PLINEUS H MONTALVAN—9 Demonstration of contact glasses and telescopic lenses

ANDREW A EGGSTON and JOSEPH LAVAL—9 Demonstrations of eye pathology.

NORTON DEL FLETCHER and staff—2 Operations

MOUNT SINAI HOSPITAL

KAUFMAN SCHLIVK and staff—9 Cataract extraction, trephine, LaGrange, Safar for detachment, ptosis-advancement of levator

NEW YORK EYE AND EAR INFIRMARY

CONRAD BERENS and staff—9 Operations Indocorneo-sclerectomy, retroplacements, Tenon's capsule transplant, iridocapsulotomy, general operations

WEBB W WEEKS and staff—2 Operations Intracapsular cataracts, modified LaGrange, muscle operations

WENDELL L HUGHES—2 Plastic, corneal transplant

NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL

MARTIN COHEN—2 Dry clinic

PRESBYTERIAN HOSPITAL

(Institute of Ophthalmology)

JOHN A DUNNINGTON, THOMAS H JOHNSON, DANIEL B KIRBY, and ALGERNON B REESE—9 30 Operative and dry clinics

Friday

BELLEVUE HOSPITAL

WEBB W WEEKS and staff—2 Demonstrations of post-operative cases, illustrated with results from operations for cataract, glaucoma and plastic surgery of the eye and orbit

HARLEM EYE AND EAR HOSPITAL

CHARLES B MEDING and staff—2 Operations and demonstrations of cases

HOSPITAL FOR JOINT DISEASES

DAVID WEXLER and staff—2 Dry clinic

MAURICE POMERANZ and HENRY K TAYLOR—2 Planigraphy in orthopedic surgery

MANHATTAN EYE, EAR AND THROAT HOSPITAL

R TOWNLEY PATON—9 Demonstration of cornea transplanting and ophthalmic photography

GIROLAMO BONACCOLTO—9 Slit lamp demonstration

DAVID H WEBSTER and staff—2 Operations

PRESBYTERIAN HOSPITAL

(Institute of Ophthalmology)

JOHN A DUNNINGTON, THOMAS H JOHNSON, DANIEL B KIRBY, and ALGERNON B REESE—9 30 Operative and dry clinics

ST LUKE'S HOSPITAL

W GUERNSEY FREY, JR and staff—2 Operative and dry clinics

H T SMITH The Laurence-Moon-Biedl syndrome

WALTER HIPP Treatment of conjunctivitis with bacteriophage

NEW YORK EYE AND EAR INFIRMARY

EDGAR BURCHELL—10 Dry clinic Surgical anatomy of the temporal bone and its variations
J M SMITH—10 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

ARTHUR NILSEN and staff—2 Operations

NEW YORK POLY CLINIC MEDICAL SCHOOL AND HOSPITAL

HENRY B OETOV—9 Cadaver demonstration
J EASTMAN SHEEHAN—11 Lecture on otolaryngology and plastic surgery
W WALLACE MORRISON—1 Lecture
LEE M HURD—2 Operations
H G BULLWINKEL—3 Cadaver demonstration bronchoscopy

PRESBYTERIAN HOSPITAL

GEORGE R BRIGHTON—2 Bronchoscopic clinic Presentation of cases demonstration of technique of bronchospirometry

ROOSEVELT HOSPITAL

CHARLES N HARPER and R C GROVE—2 Dry clinic

ST LUKE'S HOSPITAL

WESLEY C BOWERS and staff—2 Operative and dry clinics Meningeal infections of otologic origin sinus infections and their treatment

UNITED STATES MARINE HOSPITAL

W P GRIFFITH A J HUEY and staff—2 Operations

Friday

FLOWER FIFTH AVENUE HOSPITAL

J A W HETRICK and staff—2 Operations and demonstrations of interesting cases motion pictures

HARLEM EYE AND EAR HOSPITAL

JOHN J LEVBARO—9 Voice and speech clinic
Staff—2 Operations and demonstrations of cases

Monday

HARLEM EYE AND EAR HOSPITAL

HARVEY LYON—2 Refraction clinic

MANHATTAN EYE EAR AND THROAT HOSPITAL

FRANK C KEIL and staff—2 Operations

MORRISANIA CITY HOSPITAL

JOSEPH S HORY and staff—2 Operations for cataract glaucoma and squint interesting eye conditions in relation to general medicine

NEW YORK EYE AND EAR INFIRMARY

CLYDE E McDONALD and staff—2 Operations Cataacts muscle ptosis
THURMAN L BOYES—4 Surgical treatment of ocular muscle anomalies with demonstrations of cases

NEW YORK HOSPITAL

Staff—2 Dry clinics

HARLEM HOSPITAL

HERMAN J BURMAN NATHANIEL HALPERN and CHARLES HARRIS—9 Tonsil clinic Snarestone and dissection operations

MANHATTAN EYE EAR AND THROAT HOSPITAL

MARVIN F JONES D S CUNNING T G TICKLE and staff—9 and 2 Otolological clinics
E ROSS FAULKNER WESLEY M HUNT and staff—9 and 2 Rhinological clinics
DAVID H JONES and JOHN M LORE—2 Endoscopic demonstration

METROPOLITAN HOSPITAL

J A W HETRICK and Staff—1 30 Operative and dry clinics

MORRISANIA CITY HOSPITAL

G B GILMORE HENRY J DILLEMUTH and JOSEPH LASALA—2 Bronchoscopic clinic

MOUNT SINAI HOSPITAL

RUDOLPH KRAMER and Staff—2 Operative and dry clinics

NEW YORK EYE AND EAR INFIRMARY

T L SALADERS—10 Demonstration of interesting ear and sinus cases operations
STUART I CRAIG—2 Operations

NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL

PALL S SEAGER—2 Laryngeal surgery cadaver
CHARLES M GRIFFITH—2 Sinus surgery cadaver
JAMES O MACDONALD—2 Mastoid surgery cadaver

NEW YORK POLY CLINIC MEDICAL SCHOOL AND HOSPITAL

M COLEMAN HARRIS—9 Allergy in otolaryngology
NATHAN SEITZEL—10 Lecture
THOMAS G TICKLE—11 Cadaver demonstration of facial palsy
MALCOLM W CARR—1 Oral surgery in otolaryngology
CHARLES J IMPERATORI—2 Operations
M H KATZ—3 Lecture

OPHTHALMOLOGY

BERNARD SAMUELS Intra-ocular tumors lecture illustrated with anatomical preparations Demonstration of anatomical specimens and teaching models
MILTON L BERLINER Sht lump demonstration
N BLAIR SULOUFF Practical points in refraction

NEW YORK CITY HOSPITAL

RAYMOND E MEER and FRANK C KEIL—2 Operative and dry clinics

NEW YORK POLY CLINIC MEDICAL SCHOOL AND HOSPITAL

ERVIN TOROK—3 Operations

RIVERSIDE HOSPITAL

CLIFFORD W ELLISON—3 Eye conditions in tuberculous patients

Tuesday

BELLEVUE HOSPITAL

WERNER W WEEKS and staff—2 Operations for cataract glaucoma and squint

MERRILL N FOOTE and SILIK H POLAYES Acute appendicitis, B welchii blood stream infection, extrusion of entire spleen, cure, presentation of patient

JEWISH HOSPITAL

WILLIAM LINDER and staff—9 General surgical operations, resection for carcinoma of the stomach
HENRY LOURIA and staff—9 General surgical operations
DAVID FARBER Thyroidectomy
FRANK TELLER Problem of recurrent hyperthyroidism
LOUIS BERGER and staff—9 General surgical operations and dry clinics
DAVID TEPLITSKY Colonic resection for carcinoma
RALPH WOLFE Organization of the gastro-intestinal surgical division
MILTON J RADER Dry clinic Acute appendicitis, twenty-year study at Jewish Hospital
ROBERT E ROTHENBERG Dry clinic Retroperitoneal cyst
PAUL ASCHNER and staff—9 Genito-urinary surgical operations and dry clinics
ABRAHAM PROGBIN Nephrectomy for tuberculous kidney
SAUL PARNASS Second stage prostatectomy
LOUIS T MORSE Urological approach to treatment of essential hypertension
PAUL ASCHNER, DAVID M GRAYZEL, MAX LEDERER, MILTON G WASCH Dry clinic Exhibit of tumors of kidney, ureter, bladder, and prostate, classification, diagnosis, pathology, treatment
LEO M DAVIDOFF and ISADORE M TARLOV—9 Neurosurgical operations Right transfrontal craniotomy for suprasellar meningioma Demonstration of electroencephalography
E LEO BERGER and staff—9 Otolaryngological operations
PHILIP LEIBOWITZ, CARL KAPLAN, CHARLES BREITMAN, BERNARD WELT Radical mastoidectomy Demonstration of bronchoscope
LEO S SCHWARTZ and staff—9 Gynecological and obstetrical operations
SAMUEL SCHENCK, SAMUEL A WOLFE, EMANUEL V LITTAUER Vaginal plastic operation Hysterectomy

KINGS COUNTY HOSPITAL

Operative and Dry Clinics—9 30

EDWIN FISKE Thyroid clinic
ROBERT F BARBER Operation, colon surgery
EDWARD P DUNN Operations, general surgery
CHARLES B JONES Operations, general surgery
JOSEPH TLNOPYR Fracture demonstration, ward walk
JOSEPH RAPHAEL Fracture demonstration, operation.
H WRIGHT BENOIT Thyroid operation
WILLIAM ENNIS Open reduction of fractures
NICHOLAS RYAN Gastric ulcers, statistical study
OTTO KAR TENOPYR Fracture demonstration
WALTER COAKLEY Plastic surgery, operations, two hours
CHARLES S COCHRANE Ward walk, display of x-ray pictures of kidney, ureter, and bladder
MATTHEW GOLDEN Operative and dry clinic
WALTER MOEHL Demonstration of ophthalmic operations
J B L'EPISCOPO Demonstration of bone block operation for painful hip
RALPH GARLICK Plastic operation for prolapse
JOSEPH MCGOLDRICK Operation, hysterectomy
CHARLES MUELLER Gynecological operations
HENRY GOUBAUD Statistical study of placenta previa

CHARLES GORDON. Gynecological operation
MORRIS GLASS Ward demonstration, cardiac conditions in pregnancy, toxemia in pregnancy
EDWIN GRACE Pectoral transplant for coronary occlusion

LONG ISLAND COLLEGE HOSPITAL

Operative Clinics—9

EMIL GOETSCH Thyroidectomy for exophthalmic goiter
ALFRED C BECK Cesarean section
FEDOR SENDER and staff Tumors of the kidney
RALPH HARLOE Empyema Operation Closed treatment of all types
WILLIAM A JEWETT Fothergill operation
HARVEY B MATTHEWS Vaginal plastic under local anesthesia
GEORGE W PHELAN Tumors of the round ligament
MERVYN V ARMSTRONG Episiotomy and repair under local anesthesia
GEORGE HORTON Nephrectomy

Dry Clinics—10 30

S POTTER BARTLEY Fractures of the foot, clinical and economic aspect, lantern slides
HERBERT C PETT Arthrotomy of the knee joint, report of experiences
ROBERT F BARBER Malignant tumors of peripheral nerves, cases and specimens
SAMUEL A WOLFE Demonstration of ovarian tumors

METHODIST EPISCOPAL HOSPITAL

HAROLD K BELL, HENRY F GRAHAM, PIERRE A RENAUD, SEYMOUR G CLARK, JOHN A TIMM, and staffs—9 General surgical operations

Dry Clinics

S G CLARK Vascular tumors of the liver
HAROLD K BELL Intussusception with Meckel's diverticulum
MILTON E HOEFLE Use of long intestinal tube for relief of intestinal obstruction
OSCAR P SCHOENEMANN Planography in tuberculosis
HAROLD E RHAME Elliott treatment for pelvic inflammations
C DOUGLASS SAWYER The peritoneoscope
J H BLISS Primary carcinoma in a branchial cyst
KENNETH H MACGREGOR Surgical indications for blood transfusions
H RUSSELL MEYERS—9 Neurosurgical dry clinic Chronic subdural hematoma in infancy
DONALD E MCKENNA, HENRY F GRAHAM, HAROLD K BELL, JOHN A TIMM and staffs—11 Fracture clinic
JOHN A TIMM Use of Soutter apparatus for reduction of fractures of both bones of forearm
HENRY F GRAHAM An efficient method for reduction and retention of Colles' fracture
HENRY P LANGE Fracture of radius and ulna, lower fifth, in adolescence
HOWARD T LANGWORTHY and ROSARIA P MULE—9 Genito-urinary surgery, urological exhibit
ROSARIA P MULE—11 30 Medical aspects of prostatism
CHARLES L STONE, CHARLES A ANDERSON, EINAR A SUNDE, and staffs—11 Otolaryngological operations and dry clinics
CHARLES L STONE and CHARLES A ANDERSON Dry clinic. Ligation of the common carotid artery for hemorrhage
JOHN F FORD—9 Plastic surgery, dry clinic The cosmetic aspect of rhinoplastic surgery

BROOKLYN-LONG ISLAND DAY--WEDNESDAY

OPERATIVE AND DRY CLINICS--9-12 30

BROOKLYN CANCER INSTITUTE

Operative Clinics--9

- J J GANNEY and GEORGE REITZ Radical mastectomy two cases
 J MCGOLDRICK Carcinoma of the cervix
 I SIRUS One stage Miles resection for carcinoma of rectosigmoid
 G ROBILARD Surgery of the colon
 E K MORGAN Uterostomy for carcinoma of bladder

Dry Clinics--9

- W F HOWES Pre operative radiation of the breast
 S G SCHENCK Bronchial carcinoma and review of six autopsy cases
 H. CHARACHE Neurogenic sarcoma Eighteen cases with statistical study and lantern slides
 J SCHMIDT Carcinoma of the larynx presentation of operated and radiated cases, wax model demonstration
 H S RASI Oral surgery in malignancy with wax model exhibit
 S WOLFE Carcinoma of the vulva case presentations
 L S DREXLER Carcinoma of the genito urinary tract lantern slide demonstration
 H BOLKER and H KOPPELMAN The effect of radiation on mammary tissue and breast cancer
 H I TEPPERSON X ray treatment of giant cell tumors Demonstration of cases

BROOKLYN HOSPITAL

- ERNEST K TANNER and staff--9 General surgical operations

ERNEST K TANNER D D DAVIS and W H FIELD Lobectomy for bronchiectasis transposition of viscera

Clinical Presentations

- ERNEST K TANNER Review of one year's anesthesia Review of emphysema for eighteen years
 D D DAVIS Massive drip blood transfusion from blood bank
 W H FIELD Study of the results of gall bladder surgery, two five year periods
 R B MILES Comparative study of drainage versus non-drainage in acute appendicitis
 A L SMITH Analysis of surgical mortality
 S A WINNING End results of sympathectomy in Raynaud's disease
 E JEFFERTON BROWDER--9 Neurosurgical operations Surgical treatment of epilepsy Demonstration of bipolar cortical stimulation Posterior fossa approach for major trigeminal neuralgia
 NATHANIEL F RATHBUN and staff--9 Genito-urinary surgical operative and dry clinics
 N P RATHBUN H FISHER and W F McKENNA Tidal drainage of the bladder with control of time quantity and pressure factors
 H WEINSTEIN Rupture of renal cyst with extravasation of urine forming extrarenal urinary cyst
 F C HAMM Motion pictures of genito urinary surgery in children
 F C BOND Ureteropelvic obstructions Series of operated cases and x rays

- WILLIAM SIDNEY SMITH and staff--9 Gynecological and obstetrical operative and dry clinics

W S SMITH ELIOT BISHOP JOHN CASAGRANDE and GEORGE G COCHRAN Dry clinic Outline of combined medical-obstetrical clinic for care of cardiac patients Experiences with vaginal antisepsis. Survey of the obstetrical service Diagnosis and treatment of hydatidiform mole

- DONALD E McKENNA and staff--9 Orthopedic surgery
 DONALD E McKENNA Operations Arthrotomy of the knee joint

HENRY LANGE Xanthoma of knee joint.

L. GASTON PAPAIE Disease of the spine with symptoms simulating lesions of the urinary tract.

- A W MARTIN MARTINO and staff--9 Rectal surgery Abdominoperineal resection for cancer of rectum Other proctological operations. Demonstration of patients who have undergone different types of operations for cancer of rectum Visit to rectal clinic

CUMBERLAND HOSPITAL

Operative Clinics

- MERRILL N FOOTE and staff--9 General surgical operations
 CARLTON CAMPBELL Physiological gastric resection
 RUDOLPH GOLDBERG Thyroidectomy
 HOWARD BLAIR Cholecystectomy The use of stainless steel wire in abdominal closures.
 JOHN TYND and staff--9 Operations Splenectomy for Banti's disease
 STANLEY D BANKS Radical mastectomy for carcinoma of breast.
 EUGENE F VITAGLIANO Hysterectomy for fibroid
 HERBERT T WIKLE and staff--9 Operations Bone dust hernioplasty
 HENRY WAGNER Gastric resection
 HOWARD T LANCOWORTHY and staff--9 Genito-urinary surgical operations
 LEO S DREXLER Prostatectomy Nephrectomy
 FRANK H LASNER and staff--9 Otolaryngological operations
 ABRAHAM G SILVER, LOUIS R VASEY, BENJAMIN V GOTTLEB, SAMUEL KAPLAN Bronchoscopy Lateral sinus thrombosis Nose and throat operations

Dry Clinics

- WILLIAM C MEACHER and staff--9 Obstetrical dry clinic
 WILLIAM C MEACHER Cesarean sections at Cumberland Hospital
 SAMUEL LUBIN Results of attempted induction of labor with estrin
 ALEXANDER DUNBAR Operative deliveries at Cumberland Hospital
 Staff--10 General surgery dry clinic
 HARRY MARYZ Analysis of 50 consecutive ruptured gastric ulcers lantern slides
 JACK ROMASCAN Familial neurotrophic osseous atrophy demonstration of cases
 CARLTON CAMPBELL Presentation of cases of mammary tuberculosis
 SAUL F LIVINGSTON Granuloma inguinale end results of cases treated locally

CHARLES A HARGITT, JOHN N EVANS, WALTER V MOORE
and staffs Demonstration of patients

OTOLARYNGOLOGY

Morning Session—9 Operative and Dry Clinics

HARRY PATRIE Osteomyelitis of temporal bone Case
report and patient
ALEXANDER HOWE Frequency of dehydration after
mastoidectomy
SAMUEL ZWERLING Chilliness—a symptom of nasal ob-
struction

ROBERT L MOORHEAD Petrous pyramid suppuration,
cases, demonstration on cadaver
JOHN AUWERDA Bronchoscopy, interesting cases
JOHN P BAKER Cancer of the larynx, laryngectomy and
laryngofissure patients
WILLIAM HERBERT Ultra short wave therapy
EDWARD E WOODLAND Evolution of ear, nose, and throat
specialty in the Medical Corps U S Navy—25 years
EDWARD A BERGER Demonstration by specimens of
carotid approach to petrous pyramid
Operative clinics by staff Operations and operators to be
announced later

SYMPOSIA—2.00-4.00

GENERAL SURGERY

Biliary Surgery—Jewish Hospital—Moderator LOUIS BERGER

LOUIS J MORSE Clinical analysis of gall bladder disease
at the Jewish Hospital for the past ten years
THEODORE BARNETT Study of intraductal and sphincter
pressure in common duct drainage cases
BERT B HERSHENSON Anesthesia—its relation to sur-
gery of the gall bladder
DANIEL A McATEER Physiology of the liver and biliary
tract
RUSSELL S FOWLER Why to operate, when, and what
operation to do in acute cholecystitis
STUART A WINNING Pre-operative and postoperative care
in biliary surgery

Surgery of the Thyroid Gland—Long Island College Hospital—Moderator. EMIL GOETSCH

EMIL GOETSCH Operative and postoperative reactions in
thyroidectomy for hyperthyroidism
ARTHUR GOETSCH Hyperthyroidism in children
BENJAMIN CISEL Pathological conditions of the thyroid
gland
HAROLD K BELL Care of thyroid cases on a general sur-
gical service
EDWIN H FISKE Amount of thyroid gland to be removed
in mild hyperthyroid cases
HARRY FELDMAN A safe and standardized thyroidectomy
technique, colored motion pictures
A STORRS WARINNER Tuberculosis of the thyroid gland

Gastric Surgery—Methodist Episcopal Hospital— Moderator HENRY GRAHAM

GEORGE W CRAMP X-ray diagnosis of gastric lesions
ALBERT F R ANDRESEN The 1938 ulcer diet, physiologi-
cal basis, Meulengracht diet
W WRIGHT BENOIT Pyloric obstruction in infancy
JOHN E HAMMETT Surgical treatment of ulcer
WILLIAM LINDER Surgical treatment of cancer of the
stomach
PIERRE A RENAUD Important points in the technique of
gastric operations
J HERBERT BLISS Gastrojejunal ulceration
WILLIAM H FIELD Causes of failure after gastric opera-
tions

Thoracic Surgery—Kings County Hospital— Moderator EDWIN J GRACE

EDWIN J GRACE Address of welcome
IRWIN L SIRIS Lobectomy for bronchiectasis
WILLIAM H FIELD Review of postoperative specimens of
bronchiectasis

WILLIAM E HOWES Exhibit of bronchial carcinoma with
review of autopsied specimens
ARTHUR S W TOUROFF Acute abscess of the lung
EDWIN J GRACE and CHALMER D DIXON Phrenic nerve
operations for pulmonary tuberculosis, end-results of
300 cases
RALPH F HARLOE The problem of empyema in pulmo-
nary tuberculosis

Lesions of the Breast—St John's Hospital— Moderator JOHN E JENNINGS

JOSEPH TENOPYR and IRVING SILVERMAN Diagnosis of
tumors of the breast, new biopsy punch
L ALBERT THUNIG Frozen section technique
WILLIAM E HOWES Pre-operative radiation of the breast
HAROLD KOPPELMAN and HERMAN BOLKER Effect of
radiation on mammary tissue and breast carcinoma

Surgery of the Rectum and Colon—Brooklyn Hospital —Moderator ERNEST K TANNER

J HERBERT BLISS Cancer of the rectum, surgical methods
of approach with special consideration of one-stage
resection
GEORGE WEBB Use of Abbott tube in intestinal obstruc-
tion
JAMES WATT Acute obstruction of the large intestine
A W MARTIN MARINO Review of 114 cases of carcinoma
of the rectum and rectosigmoid
ARTHUR HOLZMAN Surgery of the ascending colon
BENJAMIN SEAMAN The Devine operation in colon sur-
gery
BERNARD S PUPEK Treatment of carcinoma of the colon

Surgery of Peripheral Vascular Diseases—St Mary's Hospital—Moderator ROBERT F. BARBER

HAROLD RABINOWITZ Treatment of thrombo-angitis
obliterans based upon new concepts of the pathogenesis
and pathological physiology of the disease, lantern slides
HUGH L MURPHY Experience in treating peripheral vas-
cular disease with pavaex, evaluation of results in over
125 cases New method in treating thrombophlebitis
with mecholyt iontophoresis
FRANK N DEALY Surgery of peripheral vascular diseases
ROBERT F BARBER Experience with aneurysm
HERBERT T WIKLE Allergy simulating peripheral vas-
cular disease

Acute Osteomyelitis—St Mary's Hospital— Moderator WILLIAM V. PASCUAL

DANIEL E WELCH Multiple lesions of acute osteomyelitis
JOHN M SCANNELL Modern treatment of acute osteomye-
litis in children

O PAUL HOMPTON RALPH M. BEACH HARVEY B. MATTHEWS HARRY W. MAYES GEORGE H. DAVIS and staffs—9 Operations and ward rounds in obstetrics

ST JOHN S HOSPITAL

Operative and Dry Clinics—9

JOHN E. JENNINGS Radical mastectomy with ligation of axillary vein Treatment of inoperable breast cancer
FRANK SAMMIS Grill graft plastic
STANLEY B. THOMAS and GEORGE R. MARSH Gastro-intestinal surgery Cancer of colon megacolon review of cases
AUGUSTUS HARRIS Surgical attack on anomalies of kidney and ureter cases and results reviewed
S. LLOYD FISHER Surgery of the female pelvis
JAMES L. COBB and GEORGE B. REITZ Acute and traumatic surgery operations and demonstrations
L. ALBERT THURNG Anomalies of the umbilicus

Co-ordinated Medical and Obstetrical Demonstrations
CAMERON DUNCAN Handling of labor in tubercular cases and postpartum care
LOWELL B. ECKERSON Back pain associated with gastrointestinal lesions
CHARLES E. HAMILTON Collapse therapy in tuberculosis of the lung
CARL GREENE The acute gall bladder
PAUL PARRISH Pyloric stenosis in infants
FRED MAISPL. Surgical photography
JOHN B. KYAPP and WILLIAM RICHARD CASHION Roentgenography and x ray therapy
LEONID WATTE Anesthesia procedures

ST MARY S HOSPITAL

WILLIAM PASCUAL THOMAS M. BRENNAN PETER DOLLE and staffs—9 General surgery operative and dry clinics
SANFORD SHUMWAY Selected fracture problems
DANIEL WELSH Acute intestinal obstruction due to gall stone occlusion
HUGH MURPHY Mecholyl iontophoresis in the treatment of thrombophlebitis
PETER DULLIGAN Management of acute intussusception
THOMAS BRENNAN Cases illustrative of retroperitoneal hemorrhage and other types of abdominal trauma
WILLIAM PASCUAL Atypical appendicitis difficulties in recognition and management
JOSEPH RIZZO Appendicitis in pregnancy
HUGH MURPHY and V. TESORIERO Vascular clinic demonstration of cases and methods of treatment
ANDREW J. MCGOWAN FRANK C. HAMM and staffs—9 Genito urinary surgery operative and dry clinic
FRANK C. HAMM Transurethral prostatectomy
ANDREW J. MCGOWAN Pediatric urology
GEORGE PRICE and WILLIAM VOITRIER JR.—9 Pathological demonstration skin tumors ovarian tumors in their relationship to sex
JOHN SHIELDS and staff—9 Proctological dry clinic
HERBERT C. FETT and staff—9 Orthopedic surgery selected problems
ALBERT KEENAN JOHN AGUERDA and staffs—9 Otolaryngological surgery
E. A. KEYES H. GOUTBEAU C. LUGHERAN R. WILSON and staffs—9 Gynecological and obstetrical operations Vaginal hysterectomy (local) anterior and posterior colpocathexis (local) panhysterectomy (spinal) laparotomy for ovarian cyst

Roentgenological Department—9

FRANCIS CURRY Exhibits
PAUL RALA Cholangiography in biliary tract disease
FRANCIS CURRY Radiation in postoperative parotitis

Dry Clinic

H. GOLBEAL and staff—9 Forceps application (mann kind) Kielland Peeper axis traction. Resuscitation of newborn cadaver and motion pictures Graphs and charts dehydration mortality morbidity cesarean sections repeat sections x ray in placenta previa Blood bank in obstetrics
M. MURPHY Eight cesarean sections, ectopic pregnancy
F. MITCHELL Double pregnancy double uterus abortion at fourth month first uterus full term cesarean section living baby second uterus
CHARLES LOUCHRAN Hydattidiform mole cesarean section at term living baby
M. MURPHY Two cases abdominal hemorrhage tubal in origin not ectopic
J. MASTROYA Antepartum diagnosis triple pregnancy with x ray
H. JOYCE Electric cervix advantages and disadvantages
M. ABBENE Hydattidiform mole analysis of nineteen cases

UNITED STATES NAVAL HOSPITAL

Operative Clinics—9

CHARLES H. SAVAGE Appendectomy spinal anesthesia
JAMES J. O'CONNOR Repair of inguinal hernia local anesthesia
COURTNEY G. CLEGG Rectal clinic

Dry Clinics—10

LOUIS E. GILJE Fracture clinic
CALVIN B. GALLOWAY Cancer clinic

BROOKLYN EYE AND EAR HOSPITAL

OPHTHALMOLOGY

Morning Session—9 30 Dry Clinics

E. CLIFFORD PLACE Keratoconus treated with contact lenses Sarcoma of the choroid
CHARLES A. HARGITT Hereditary juvenile glaucoma two families
RALPH I. LLOYD Birth injuries of the cornea and allied conditions
WALTER V. MOORE Scleromalacia perforans report of four cases
WILLIAM F. C. STEINBUGLER Ophthalmomyiasis anterior
MORTIMER A. LASKY Krukenberg's spindle
DANIEL KRATITZ Hodgkin's disease of the lid
IRVING JACOBS Spherophakia ectopia lentis with lens extraction O.U.
JOHN N. EVANS Preparation for operation and aftercare of glaucoma cases

Motion Picture Demonstrations

P. CHALMERS JAMESON Jameson recession
WALTER MOERLE Cataract extraction a new technique

Afternoon Session—9 30 Operative Clinics and Symposium
JOHN H. OHLY DAVID T. BISHOP and staffs Symposium on retinal detachment
P. CHALMERS JAMESON and E. CLIFFORD PLACE Operative clinics

SURGERY

GYNECOLOGY AND OBSTETRICS

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TUMORS AT THE APEX OF THE CHEST

BRONSON S RAY, M D, New York, New York

WE are indebted to Pancoast for calling to the attention of the medical profession a clinical picture characterized principally by unilateral pain in the shoulder girdle and upper extremity, Horner's syndrome, paresis of the hand and the presence of an abnormal roentgenographic apical shadow, all due to a neoplasm at the apex of the chest. He himself referred to the new-growth as a "superior pulmonary sulcus tumor," and perhaps this designation is as good as any although others have objected to it because there is no such recognized anatomical site and because Pancoast meant the name to imply a special kind of tumor having its origin other than from lung, pleura, ribs, or mediastinum. Since an increasing number of reported cases show that various types of new-growth can occupy the region of the thoracic apex and produce the same symptom complex, it becomes obvious that a particular kind of neoplasm is not implied.

Reports of over 50 cases of tumor at the apex of the chest having clinical manifestations more or less alike can now be found in the medical literature (2 to 7, 9 to 15, 17 to 19; 21, 22, 26, 27, 30 to 32). Not all of these have sufficiently complete records, but I have chosen those that justify comparative study and after adding the reports of 5 illustrative cases, I propose to summarize the anatomical, patho-

logical, clinical, and therapeutic features of this interesting group, putting special emphasis on neurological manifestations.

REPORTS OF CASES

CASE 1 (Hist No 47745) Initial pain in right shoulder blade, painful hyperesthesia of the right upper extremity, right Horner's syndrome, atrophy and weakness of right upper extremity, torticollis, abnormal radiographic shadow at the apex of the right chest. Negative exploration of the supraclavicular region, insufficient posterior root section for relief of pain, paravertebral exploration and biopsy of tumor. Roentgen therapy. Continued pain and morphine addiction. Death. Autopsy: primary carcinoma of the pancreas with metastasis to the apex of the right lung, pleura, and adjacent structures.

H K, aged 36 years, a native born clothing salesman, had been a patient in the New York Hospital previously, having had a gastro-enterostomy in September, 1934, for partial duodenal obstruction supposedly caused by an ulcer. He was readmitted in April, 1936, with the following history:

Clinical history. In January, 1936, he developed a burning pain in the region of the right shoulder blade and a few days later a similar pain down the inside of the right upper extremity. Within 2 weeks he and friends noticed drooping of his right upper eyelid. The pain was persistent but bearable. When weakness of the muscles of the right upper extremity appeared in April he was admitted to the hospital. At this time he required daily about 3 grains of codein which gave him only partial relief from pain that now had extended into a large part of the extremity and upper chest. Any motion of the extremity was avoided and anything lightly touching the inside of the arm was especially disagreeable. There had been no cough, sputum, nor weight loss.

From the Department of Surgery of the New York Hospital and Cornell Medical College

ADAM WORTH L. SMITH Conservative operating in acute osteomyelitis
 SEYMOUR C. CLARK Etiology of acute osteomyelitis
 S. LLOYD FISHER Diagnosis in acute osteomyelitis
 DANIEL A. McVIEE Pathology of acute osteomyelitis

OBSTETRICS AND GYNECOLOGY

Hemorrhage Associated with Pregnancy—Methodist Episcopal Hospital—Moderator O. PAUL HUMPSTONE

ONYSLOW A. GORDON Abortion
 FLOR BISHOP Unusual antepartum lesions
 RALPH M. BEACH Placenta previa
 G. HAMILTON DAVIS Ablatio placenta
 HENRY J. COUBEAUD Ruptured uterus
 HARRY W. MAYES The postpartum period
 HARVEY B. MATTHEWS The puerperium

Maternal Welfare and Toxemias of Pregnancy—Long Island College Hospital—Moderator ALFRED C. BECK

There will be a one hour demonstration under the Chairmanship of Dr. Charles Gordon of the actual conduct of the Committee on Maternal Welfare of the Medical Society of the County of Kings. This Committee has for its purpose the improvement of obstetrics by an analysis of the causes of all maternal deaths, the assignment of the responsibility for the same and suggested remedies.

Toxemias of Pregnancy

MERVYN V. ARMSTRONG The management of hyperemesis gravidarum
 FRANK F. LIGHT Nonconvulsive late toxemia
 ALFRED C. BECK Convulsive late toxemia

FRACTURES AND TRAUMATIC SURGERY

Cumberland Hospital—Moderator FUAD I. SHATARA
 JOSEPH RAPHAEL Observations on local anesthesia in the reduction of fractures report of 100 cases
 HAROLD DRAFFEN Treatment of compound fractures
 ARCHIE M. BASER Fracture clinic in a small hospital
 J. EARL MILES Pinning of fractures about the elbow joint
 GEORGE B. FEITZ Transportation of head injuries Made Jung's deformity value in diagnosis of dislocation of the wrist
 JOSEPH I. ANTON Treatment of nerve injuries
 LEO FASKE Trimalleolar fracture
 S. POTTER BARTLEY Management of fractures of the os calcis.

GENITO URINARY SURGERY

Treatment of Malignant Diseases of the Genito Urinary Tract—The Brooklyn Hospital—Moderator NATHANIEL P. RATHBUN
 HENRY H. MORTON Address of welcome

FREDOR L. SINGER The kidney and ureter
 HEINRICH L. WEHRBEIN The adrenal
 LAUL WILLIAM ASCHNER The bladder—clinical application of pathologic data
 EDWIN KING MORGAN The bladder—endovascular treatment
 AUGUSTUS HARRIS The bladder—open surgical treatment
 HOWARD LANG WORTHY The penis
 J. ST. ADIVANT READ The prostate
 LT. C. B. GALLOWAY Present day management of teratoma of the testicle

SURGERY OF THE BONES AND JOINTS

Kings County Hospital—Moderator JOSEPH B. L. FISCOPO

CHARLES D. NAPIER Vertebral epiphysitis in adolescence
 HERBERT C. FETT Fractures of the forearm in children
 OTTO C. HUDSON Fracture of the astragalus
 BENJAMIN KOVEN Osteomyelitis of the spine treated by graft fusion lantern slides
 JOSEPH B. L. FISCOPO Demonstrations of bone block operations for painful hips
 L. GASTON PAPAE Acute epiphysitis of the hip joint
 CARL A. HETTESCHEIMER Relief of lumbar backache by excision of the twelfth rib

NEUROSURGERY

Jewish Hospital—Moderator LEO M. DAVIDOFF
 E. JEFFERSON BROWDER and FLOYD BRAGDON Physiological effects of drugs and hypertonic solutions in the normal and pathologic state
 RUSSELL MEYERS Report on a series of operations for so called epilepsy
 RICHARD CRIMPS Review of 350 cases of fracture of the spine with and without spinal cord injury
 CUY LAUDIG Report on 110 cases of subdural hematoma
 LEO M. DAVIDOFF End results in a series of brain tumor operations after ten to twelve years. Studies in electroencephalography and pneumoencephalography
 ISIDORE M. TARLOV The brain and experimental lead poisoning Tumors originating in the intracranial portions of the cranial nerves other than the acoustic nerve.
 JOSEPH STRIS Studies on the blood brain barrier
 AVATOLE KOLODYNI Some infrequent spinal cord lesions lantern slides

OTOLARYNGOLOGY

Blood Stream Infections Complicating Ear Conditions—Brooklyn Eye and Ear Hospital—Moderator ROBERT L. MOORHEAD
 THOMAS B. WOOD Variations in size and course of the lateral sinus
 CHARLES WEEH Diagnosis
 MATTHEW C. GOLDEN Results of sulfanilamide treatment
 PHILIP LEIBOWITZ Management of infections



Fig 2 Case 1 Photograph of autopsy specimen showing tumor involving the medial apex of the right lung

In the chest, both lungs appeared congested. The apex of the right lung was occupied principally in its medial aspect by a large, firm tumor mass (Fig 2). It was adherent to the parietal pleura and in turn to the vertebral ends of the first two ribs which were also invaded by the mass. The tumor had grown around the lower nerves of the brachial plexus and impinged on the upper thoracic nerves as they emerged from their foramina. The sympathetic chain was not identified. There were a few small grayish nodules scattered through both lungs and in several other ribs. There were no enlarged nodes in the mediastinum. The heart was not unusual except for a hard nodule, 1.5 centimeters in diameter, in the wall of the right ventricle.

Microscopic examination of the region of the head of the pancreas (Fig 3) shows masses of tumor cells arranged singly, in large sheets or in the form of giant cells. The cells differ in size, shape, and staining quality, they measure from 10μ to 50μ . Many nuclei are large, some contain much chromatin and

others only fine granules. Between the tumor cells is hyalinized connective tissue. Here and there are small masses of pancreatic tissue, the architecture is greatly altered, the acini being small with imperfect lumina. The pancreatic ducts are increased in size and number. Lymphatic sinuses are invaded by tumor cells.

Microscopic examination of the apex of the right lung (Fig 4) reveals avascular fibrous tissue infiltrated with large masses of tumor cells. These cells are arranged in sheets, in syncytial and in acinar formation. They are anaplastic, differing greatly in size, shape, and staining quality. In some areas there are masses of debris on which coal pigment is superimposed, there are lymphocytes and mononuclear cells at the periphery of these areas. At the periphery of the tumor are a few epithelioid cells.

The primary diagnosis included carcinoma primary in the head of the pancreas with extension to the duodenum, common bile duct, regional nodes,

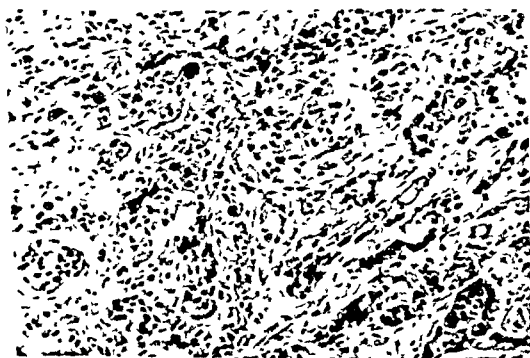


Fig 3 Case 1 Photomicrograph of the tumor of the pancreas (Hematoxylin-eosin) $\times 115$

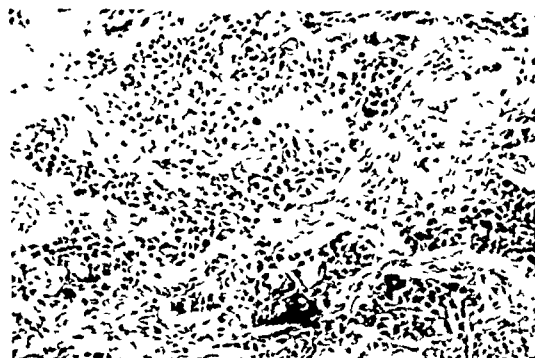


Fig 4 Case 1 Photomicrograph of the tumor of the lung (Hematoxylin-eosin) $\times 115$

Examination The patient's facial expression testified to the degree of pain he was suffering especially with movement of the right arm. He inclined his head slightly toward the right. The Horner's syndrome was complete on the right. There were patchy areas of anhidrosis over the right upper chest and upper extremity. Goose flesh and profuse sweating were found to occur in a well demarcated area on the inside of the arm from the axilla to a point just below the elbow sometimes occurring spontaneously and sometimes resulting from lightly stroking the skin of this region. There was no fullness in the neck or supraclavicular region. The heart and lung findings were normal and blood pressures were equal in the two arms. There was no sensory loss anywhere but a hyperesthesia was distinct over the right scapula and along the inside of the right arm and forearm. There was slight atrophy of some of the small muscles of the right hand and a resultant weak grip. Reflexes were normal in the upper extremities as they were elsewhere in the body.

The temperature was normal and the pulse rate averaged 90. The routine laboratory findings were within normal limits. Roentgenographic examination of the chest from the beginning of his illness had shown soft infiltration of the right apex which had been considered to be tuberculosis (Fig 1). Unsatisfactory sputum specimens persistently failed to show tubercle bacilli.

First operation (May 10, 1936) Under ethylene anesthesia the region of the right brachial plexus was explored but no abnormality was found. Soon after operation 1,800 R units of roentgen therapy were given through three ports to the region of the right apex of the chest. Pain became somewhat less distressing and the patient was discharged. At the end of 4 weeks he returned beseeching that something be done to relieve the pain in his right scapular region and in the right upper extremity. Examination showed much the same as it had before except for increased weakness in the right hand. A lumbar

puncture revealed normal fluid and normal dynamics.

Second operation (June 23, 1936) Under ether anesthesia a dorsal laminectomy was done and the sensory roots of the first, second, third and fourth thoracic segments were cut. No tumor was seen during this operation. The operation was followed by relief of pain in the upper chest and scapular region but pain persisted in the right hand and forearm. Again the patient was discharged and regular doses of codein were prescribed. He returned after 5 weeks because the pain in the extremity was increasing and he was also having increasing pain in right side of neck. Examination showed progressive generalized weakness and loss of 10 pounds.

Third operation (August 20, 1936) Under ether anesthesia an incision was made to the right of the upper dorsal spines a segment of the third rib was removed and an infiltrating tumor was found extending in all directions from this point. A piece of the tumor was taken for study. Microscopic examination of this tissue showed what was thought to be a secondary carcinoma of epithelial origin.

Roentgen therapy was reinstituted and eventually about 6,000 R units were administered through three ports. He obtained partial relief of pain for several weeks but from then on he required increasing amounts of morphine which never completely relieved him of what appeared to be devastating pain. He never moved or allowed to be moved the upper extremity and he inclined his head toward the right almost at right angles to lessen the pain on that side. He developed a loose cough and raised about 20 cubic centimeters of sputum daily. Irritated and deepening jaundice appeared. The tissues of the upper extremity became slightly edematous, the veins of the arm distended and later thrombosed. Roentgenograms of the chest repeated at regular intervals since the onset of his illness up until the last month showed only moderate increase in the density at the apex and late films revealed destruction of right transverse process of first thoracic vertebra. The patient died December 20, 1936.

Autopsy (No 8721) The body was that of an emaciated and jaundiced male who appeared older than his age of 36 years. The head and neck were deviated to the right; there was light fullness in the supraclavicular space with atrophy of the right upper extremity. There were healed incision of the neck, back and abdomen. Decubitus ulcers existed over both buttocks.

In the abdomen there were numerous adhesions and a posterior gastrojejunostomy. There was a large hard mass about 6 centimeters in diameter in and about the head of the pancreas and invading the wall of the duodenum producing a partial constriction of its lumen. The common bile duct passed into the mass and was no longer recognizable; the common and hepatic ducts proximal to this point were greatly dilated. The liver, adrenal and kidneys contained numerous firm nodules of grayish-white tissue.



Fig 1. Case 1. Roentgenogram taken 3 months after the onset of illness showing faint shadow at the right apex of the chest.

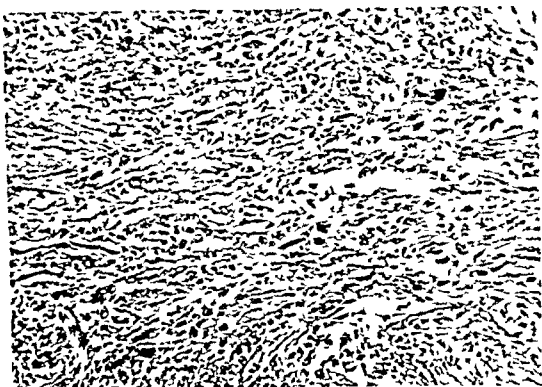


Fig 6 Case 2 Photomicrograph of biopsy of the tumor. (Masson stain) $\times 115$

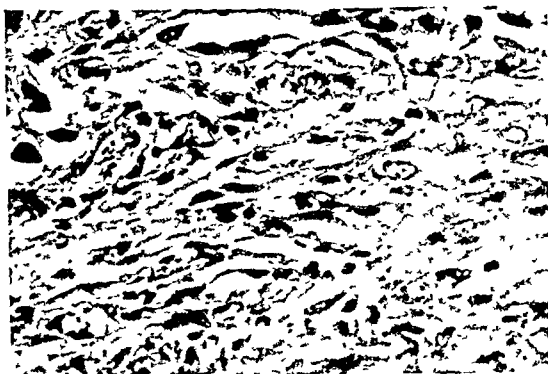


Fig 7 Case 2 Photomicrograph of biopsy section of the tumor (Masson stain) $\times 365$

In February, 1936, he developed pain between the right scapula and the third dorsal spine and shortly after, a radiating sharp pain around the upper right chest. At his own suggestion he was given roentgen therapy over the upper dorsal spine with partial relief of pain. In August, 1936, 2 weeks before hospital admission, burning pain appeared over the right shoulder, in the right axilla and radiated down the inner side of the right upper extremity. Ten days later he noticed for the first time that perspiration had ceased in the face, upper extremity, and upper chest on the right side. Ten days after admission, myosis, ptosis, and enophthalmos appeared on the right to complete the Horner's syndrome. There had been no chronic cough, and the patient suffered no loss of weight.

Examination The patient was a young man of slender build but good development and there was nothing unusual about his appearance except that he was careful about moving the right upper extremity. The head functions were normal but for absent sweating on the right (later the rest of the Horner's syndrome developed). There was no fullness or tenderness in the neck, supraclavicular region, or upper back. At the right apex breath sounds were slightly diminished. Blood pressure observations in the two arms were equal. There was no atrophy nor weakness in the right upper extremity. Sensation was impaired in an area over the right chest corresponding to the second and third segments and this area extended into the axilla and to a point just below the elbow on the inner side of the arm. Sweating was absent over the extremity, upper chest, face, and neck, on the right. Reflexes in the arms were equal as they were elsewhere.

The routine laboratory findings were normal. No sputum could be obtained. The temperature was normal and the pulse averaged 90. Roentgenograms of the chest showed the faintest haziness of the medial portion of the right apex and a suggestion of early erosion of the vertebral end of the right third rib (Fig 5, a and b).

Operation Under ethylene anesthesia, the patient was placed in prone position. An incision was made to the right of the upper dorsal spines and a stony hard tumor was discovered protruding through the space between the vertebral ends of the second and third ribs and invading the adjacent muscles. A specimen of the tumor was obtained for microscopic study and the wound was closed.

Examination of the tissue microscopically showed a rather homogeneous tumor. As may be seen in Figures 6 and 7, it is composed of intertwining bundles of cells, some in cross, some in horizontal, and some in tangential section. The cells for the most part are small but in places the nuclei are large and mitotic figures can be seen with high power. Multilobed giant cells are fairly numerous. Though in places the cellular components are of a dense nature, far more numerous areas show marked vacuolization suggesting that much fat has been lost in preparation. The last fact emphasizes the probability that this is a neurogenic tumor, having its origin in the sheath of Schwann. Diagnosis: neurogenic fibrosarcoma. (Diagnosis by Dr. N. C. Foot, Department of Surgical Pathology.)

Course Recovery from operation was prompt but the pain continued as before. He was given a total of 19,000 R units of x-ray irradiation through seven ports during the next 4 months. There was temporary relief of pain but it was only transient and long before the treatment was finished he was taking regular doses of morphine. Roentgenograms of the chest taken at monthly intervals showed no change in the shadow at the right apex but an increase in erosion of the third rib. The sites of pain were persistently in the right upper chest, scapula, and extremity. Any motion of that extremity or of the head would bring cries of pain. Ordinary doses of morphine were insufficient and even when he was getting as much as $\frac{1}{2}$ grain every 2 hours, he bitterly accused the doctors and nurses of withholding medication. Marked atrophy of the entire right upper extremity developed and the appearance of

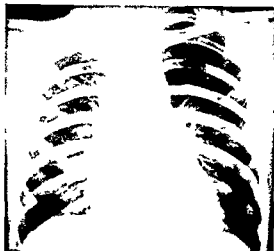


Fig. 3. Case 2. Roentgenograms taken about 1 year after the onset of illness showing a left an abnormal shadow at the right apex of the chest and b erosion of the vertebral end of the right third rib.

and metastases to adrenals, kidneys, liver, small intestine, diaphragm, lungs, pleura, ribs, axillary nodes, myocardium and skull; chronic interstitial pancreatitis; obstructive cirrhosis of the liver; chronic passive congestion of the spleen; edema of the lungs; congestion of the lungs; bronchopneumonia of all of the lobes; atrophy of the epicardial fat.

The accessory diagnoses included: healed wounds of appendectomy, cholecystectomy and gastrojejunostomy; fibrous pleural adhesions; fibrous abdominal adhesions; Meckel's diverticulum; retention cyst of kidney; fibrous scar of left pulmonary apex; calcified tracheobronchial nodes; right hemorrhoids; generalized arteriosclerosis; slight and coronary moderate myocardial fibrosis. (Report from Department of Pathology, Cornell Medical College.)

When this man complained first of pain in the scapular region a roentgenogram of the chest was done more or less as routine. The apical shadow was thought without question to be due to tuberculosis. When the Horner's syndrome appeared it too was thought to be a result of apical tuberculosis but the increasingly severe pain in the extremity suggested a tumor at the apex invading the brachial plexus. The supraclavicular operative approach gave insufficient exposure to demonstrate the tumor which was invading the nerves at the intervertebral foramina. Section of a sufficient number of sensory roots would have served to stop the pain, but in our zeal to avoid desensitizing the extremity not enough roots were cut to afford relief. After the diagnosis of tumor had been established roentgen therapy was

thought to be the most advisable treatment but its effect on pain was only transient.

It was impossible from gross pathology to determine the primary site of origin of the widely distributed tumor, those in the pancreas and apex of the lung comprised the largest growths. Microscopic studies are perhaps not entirely conclusive but the weight of evidence is much in favor of a primary cancer of pancreas with secondary growth in lung.

CASE 2 (Hist. No. 89739) Three unexplained attacks of spontaneous right pneumothorax over a period of 5 years. Initial pain in right scapular region; subsequent pain in right upper chest and inner side of right upper extremity; disappearance of sweating on right side of the body above the nipple line and right Horner's syndrome. Abnormal radiographic shadow at the apex of the right chest. Exploratory operation and biopsy. Microscopic diagnosis: neurogenic fibrosarcoma. Continued pain and morphine addiction. Death. No autopsy.

M. B., aged 30 years, an Italian physician living at the New York Hospital, came under our care August 18, 1936 with the following history:

Clinical history. In October 1930 while running upstairs he felt a sudden pain in the right chest and was found to have pneumothorax. He was sent to an sanatorium for tuberculosis where he remained some months. According to his story a diagnosis of tuberculosis was made but no tubercle bacilli were ever found. Again in February 1932 and in May 1935 he had recurrences of spontaneous but slight pneumothorax. Roentgenograms each time showed the presence of a small amount of air and a small area of clouding of the medial portion of the apex of the lung interpreted as healed tuberculous.



Fig 8 Case 3 Roentgenogram, taken about 1 year after onset of illness, showing abnormal shadow at the right apex of the chest, lateral scoliosis, and deviation of the head

portion at the right apex and a suggestion of thinning of the right second rib at its vertebral end (Fig 8) (A year previously roentgenograms had shown the same degree of clouding of the apex) Lumbar puncture disclosed normal spinal fluid and normal dynamics

Operation Under open-mask ether anesthesia the patient was placed in prone position. He took the anesthesia poorly, easily became cyanotic during the induction and even when otherwise relaxed the neck could not be completely straightened out. An incision was made to the right of the lower cervical and upper dorsal spines and segments of the third and fourth ribs were removed. Only when the pleura was stripped from the bodies of the third and fourth vertebrae could a firm, adherent mass be felt occupying the region of the apex of the lung. The mass was estimated to be 4 by 6 centimeters and was adherent to the body of the second vertebra and to the second rib. The tumor was considered inoperable and the wound was closed. No tissue was obtained for microscopic study.

There were no surgical complications and, of course, no relief of his complaints. Chordotomy or sensory root section were briefly considered for relief of his pain but it was decided to delay any procedure of this kind and rely on roentgen therapy. He was transferred to the Naval Hospital on the sixth post-operative day (February 17, 1937). At this time he required $\frac{1}{4}$ grain of morphine every 6 hours and 1 grain doses of codein between times.

Reports of his progress were as follows. 400 R units of x-ray irradiation through anterior and posterior 9 centimeter ports were given on successive



Fig 9 Case 3 Photomicrograph of the tumor of the lung (Hematoxylin-eosin) $\times 115$

days, thereafter 100 R units daily through the two ports, totaling 3,500 and 4,000 R units through each. For perhaps a month after this therapy the pain was diminished but he still required some morphine. By May, 1937, he was complaining bitterly of constant pain in the shoulder and arm. Atrophy in the right upper extremity and shoulder increased till the arm became useless. By August he was requiring a minimum of 2 grains of morphine plus 2 or more grains of codein a day and still had pain. He was then losing weight and strength rapidly. About this time he developed blood streaked sputum and also began to complain of epigastric pain, the latter was thought to be recurrence of a chronic peptic ulcer of long standing. Death followed suddenly after a vomiting attack August 7, 1937.

Autopsy (Report submitted by Dr C B Galoway, Brooklyn U S Naval Hospital) "The left lung was grossly normal. The right lung presented a chronic adhesive pleuritis involving the upper lobe. With difficulty the apex was dissected from the lateral and posterior chest wall. The original tumor was replaced by a semisolid necrotic mass measuring 5 centimeters in diameter. This area of broken down cancer extended mesially into the deep structures of the neck and upward to the brachial plexus. Viable cancer surrounded the central necrotic area and infiltrated the adjacent normal tissues. Multiple metastatic nodules were found in both adrenals, nowhere else. The skull was not opened. A healed ulcer involved the pylorus. Microscopic sections of the tumor are reported as adenocarcinoma."

Dr N C Foot concurred in the diagnosis of adenocarcinoma of the lung after examining sections sent to us for study (Fig 9).

The onset of pain followed so closely after a respiratory infection that the apical shadow seen on the roentgenogram and the symptoms, reasonably enough, were thought to be due to an inflammatory lesion in the lung and pleura.

exaggerated reflexes in the lower extremities with bilateral ankle clonus and extensor plantar responses indicated spinal cord compression. A slight non-productive cough appeared. He became emaciated and generally weak and was returned to Italy in February 1933. Death occurred shortly after his arrival home. No autopsy was performed.

Here is a patient in whom at first there was good reason to suspect pulmonary tuberculosis, three distinct attacks of spontaneous pneumothorax occurred in the 5 years preceding the onset of pain in the scapular region and upper chest. The eventual appearance of a tumor in the neighborhood must be considered as coincidence.

It is noteworthy that sweating disappeared from the side of the face and neck before the rest of the features of Horner's syndrome developed (ptosis, myosis, and enophthalmos). It is assumed from this that the tumor first invaded the sympathetic trunk in the neighborhood of the second thoracic sympathetic ganglion and later extended upward to involve the first ganglion. The tumor is definitely a malignant neurogenic neoplasm but it is exactly alike in its signs and symptoms to tumors that occur more frequently in this region. The patient was a physician and insistent on directing his own therapy. As in the first case, extensive x-ray irradiation failed to relieve the increasing pain and morphine addiction became a problem. Chordotomy had been refused early and reconsidered only when he was obviously in the terminal stages of his disease.

CASE 3 (Hist No 158115) Pain in right shoulder blade, right upper extremity, right side of neck and right anterior chest, right Horner's syndrome, atrophy and weakness of right upper extremity, abnormal radiographic shadow at apex of right chest. Exploratory operation, Roentgen therapy. Continued pain and morphine addiction. Death. Autopsy: Primary adenocarcinoma of lung.

J. C. aged 46 years, a U. S. Naval officer, was referred by Dr. C. B. Galloway on February 7, 1937 with the following history:

Clinical history. In March 1936 after an acute upper respiratory infection he developed a persistent dull aching pain in the right chest and right shoulder and down the right upper extremity. After a few months the pain became almost intolerable and by October 1936 he had given up work and all activity. The pain was a deep burning sensation and successively involved the inside of the arm, forearm and little finger. At a point over the right

third costochondral junction paroxysmal pain occurred. He noticed that this pain often appeared when he became agitated and there were beads of sweat in the region of the pain. The demarcation of this painful sweating area was so distinct that he claimed to be able to draw a circle around the area measuring a couple of inches in diameter. Sweating elsewhere over the right chest, upper extremity, neck and face had disappeared early in the course of his illness. Drooping of the right eyelid and narrowing of the right pupil appeared some time later.

By the time he was admitted to this hospital any motion of the right upper extremity caused him to cry out. Turning of the head caused pain to shoot up the right side of the neck and on occasions when this pain persisted for any length of time he developed a dull aching sensation in the right eye and in the right mandible. To avoid this he assumed the same attitude of his head as a patient with torticollis. He had required small doses of morphine daily for several weeks. There had been no cough at any time during his illness and he had lost but 5 pounds in weight.

Examination. The man had the haggard appearance of one having had much pain and sleepless nights. His head was flexed forward and to the right and the chin tilted to the left. The right arm was held fixed against the chest. There was a complete right Horner's syndrome but aside from this there were no unusual findings in the head. The right trapezius muscle was in spasm but not tender and there was no tenderness nor fullness in the neck or supraclavicular region. Breath sound at the right apex of the lung were moderately diminished. Blood pressure observations in the two arms were equal. There was no tenderness nor fullness over the dorsal or cervical spine. There was some weakness in all motions of the right upper extremity, partially due to pain but actually there was wasting of muscles of the forearm and hand. No loss of sensation was discovered but there was an area of hypersensitivity over the region of the internal condyle at the elbow. The triceps and biceps jerks were normal but the right wrist jerks were less than those on the left. Reflexes elsewhere in the body were not unusual.

There was no sweating on the right side of the body above the nipple line but on the basis of the story of a localized area of pain and sweating the patient was closely observed during a mild emotional upset. Beads of sweat appeared in an area about 5 centimeters in diameter over the third right costochondral junction; the skin was pallid here and the patient complained of a burning pain in the same area. The subcutaneous tissue inside this area was immediately infiltrated with a 2 per cent novocain and the pain promptly disappeared.

The routine laboratory findings were normal. No sputum could be obtained. The temperature daily fluctuated between 37 and 37.8 degrees and the pulse averaged 90. Roentgen examination of the chest showed clouding in the medial and superior

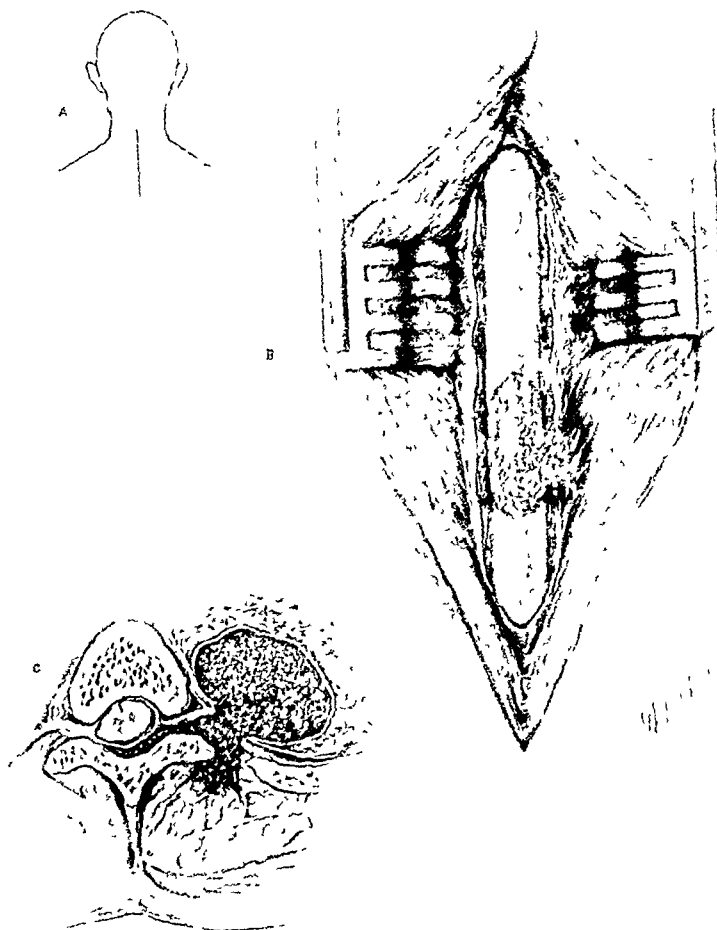


Fig 11 Case 4 A, Line of operative incision B, Laminectomy from fifth cervical to third thoracic exposing tumor invading spinal muscles, vertebral lamina and expanding into the spinal canal C, Diagram showing extension of chest tumor through the intervertebral foramen into the spinal canal and through the intercostal space into the spinal muscles

equal There was no wasting or weakness of any of the extremities but he resented active or passive motion of the right upper extremity Sensation in that extremity and elsewhere was intact but there was a very distinct hypersensitivity to light touch over the areas innervated by segments eighth cervical, first thoracic, and second thoracic on the right Reflexes were everywhere normal Sweat tests showed, besides the dry neck and head on the right side, patchy areas of anhydrosis over the right upper extremity and upper chest

The temperature was normal and the pulse averaged 60 The routine laboratory findings were within normal limits Roentgenograms of the chest

and upper spine showed a poorly defined shadow occupying the apex of the right side of the chest and a destruction of the right lamina of the second thoracic vertebra (Fig 10, a and b)

Biopsy of supraclavicular tumor Under local anesthesia this tumor was found not to be a node but a process of a larger and deeper tumor Microscopic examination of the sections showed "undifferentiated small cell carcinoma, probably from the lung"

Operation (See Fig 11) Under ether anesthesia, the spinous processes and laminae from the fifth cervical to the third thoracic, inclusive, were removed It was found that there was a rather firm,

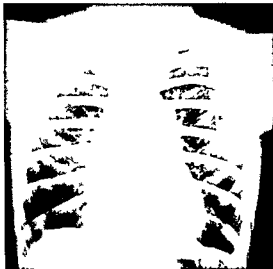


Fig 10 Case 4. Roentgenograms taken about 9 months after the onset of illness showing: a, left a dense shadow at the right apex of the chest and b, erosion of the right lamina of the second thoracic vertebra.

However in the advanced stage of this patient's illness most of the features were like those seen in the other cases.

Here again ptosis and myosis appeared after anhydrosis of the face. The other particularly interesting finding was the local area of burning pain on the chest exactly corresponding to an area of profuse sweating surrounded by an area of anhydrosis. The reasonable explanation appears to be that there was paralysis of the sympathetics to the upper right chest in all but a few remaining intact fibers which were hyperactive. Since the sweating and pain were so definitely related to emotional states the mechanism implied is one of central autonomic stimulation. The phenomenon of excessive sweating is what one might reasonably expect, since the area never flushed but had a pallid appearance possibly the local pain can be accounted for on the basis of extreme vasoconstriction. Of course since all forms of sensation were intact in this region the afferent pathway for the pain was through the intercostal nerves. Complete relief followed infiltration of novocain in the painful area.

CASE 4 (Hist No 185105) Initial pain in right axilla and shoulder additional pain in right upper extremity upper chest and side of neck increased by motion of the extremity hypersensitivity over the inside of the right upper extremity and last two fingers right Horner's syndrome abnormal

radiographic shadow at the apex of the right chest. Operation with section of sensory roots fifth cervical to third thoracic partial removal of tumor in spinal canal and direct roentgen therapy. Complete relief of pain. Microscopic diagnosis of tumor highly malignant epithelial carcinoma of unknown origin. Death from intracranial metastasis. No autopsy was performed.

E. F. aged 50 years a native born salesman came to the hospital November 3, 1937.

Clinical history. In March 1937 he developed a constant burning pain in the right axilla and in the right scapular region. In June he developed in addition a similar kind of pain in the upper right chest anteriorly and in the entire right upper extremity. The pain in the extremity was most marked over the inside of the arm the ulnar side of the forearm and in the fourth and fifth fingers light touch or pressure over these areas was particularly unpleasant. Any motion of the extremity increased the pain in all areas so that he held the extremity immobile when walking or lying on a pillow when at rest. He had been able to obtain no relief of the pain had lost much sleep and about 18 pounds in weight since the onset. A few weeks before admission a loose but non productive cough had developed.

Examination. His appearance was that of a haggard and somewhat undernourished man who lay with his right upper extremity motionless on a pillow. There was a complete right Horner's syndrome. There was a noticeable fullness in the right supraclavicular region and palpation there revealed a small firm poorly defined mass. There was also a noticeable fullness between the spines of the upper three dorsal vertebrae and the border of the right scapula. Breath sounds were diminished over the right apex. Blood pressures in the two arms were

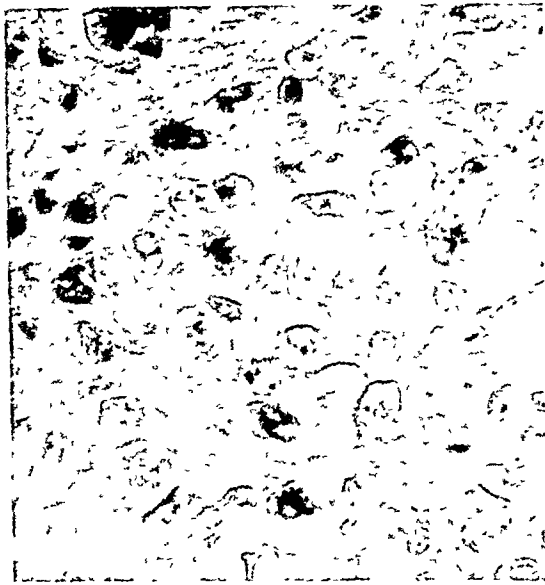


Fig 13 Case 4 Photomicrographs of tumor tissue, a, left, section made before and, b, section made after

direct x-ray irradiation of the tumor had been carried out (Masson stain) $\times 160$

sweating followed by loss of sweating in left face, neck, upper chest and upper extremity, dilated left pupil, atrophy, weakness, and areflexia of left upper extremity, palpable mass in left supraclavicular space. Abnormal roentgenographic shadow at apex of left chest. Operation with section of sensory roots fifth cervical to third thoracic. Death from postoperative pneumonia. Autopsy fibrous stenosis of esophagus (following x-ray irradiation for carcinoma) and squamous cell carcinoma of the left thoracic apex.

H B, aged 73 years, a German born janitor, was admitted to the hospital March 3, 1938, with the following history.

Clinical history In October, 1936, he began to experience increasing difficulty in swallowing and after 4 months he could hardly swallow liquids. Roentgen studies showed what was taken to be a malignancy of the esophagus at the junction of the middle and upper thirds. The diagnosis was not verified by biopsy but roentgen therapy was given (9,500 R units in 6 weeks). Marked improvement in swallowing resulted and there was a concomitant change in the roentgenographic appearance of the esophagus.

In September, 1937, he developed dull pain in the supraspinatus region of the left scapula and also in the left forearm. Soon after this he was found to have several small tender nodes in the left supraclavicular fossa, these were thought to be evidence of metastasis and roentgenotherapy was resumed. The pain improved temporarily only to return in December in more severe form. It now became a constant, deep, aching and sometimes burning pain

involving the entire left upper extremity, but was the worst in a narrow strip running down the center of the forearm into the middle and ring fingers. He had recently had a sensation of numbness as well in the same fingers. Motion of the extremity increased his discomfort so that he avoided moving any part of it. He had become aware of progressive weakness of the extremity particularly in the hand grasp. He volunteered that for several weeks prior to admission to the hospital he had noticed profuse sweating of the left upper extremity and left side of the neck and face but this had subsequently disappeared.

Examination On admission he was thin and worn looking and gave evidence of continued suffering, however, he was not emaciated. The left pupil was larger, measuring 7 millimeters as compared to 4 millimeters on the right. There was fullness but not complete obliteration of the left supraclavicular hollow, palpation here revealed a tender, deep and firm mass. The left upper extremity was weaker in all its actions and the strength of the hand grip was about one-fourth that of the other. There was slight wasting in the forearm, hypothenar eminence, and interosseous muscles. Occasional muscular fibrillations occurred in the small muscles of the hand. Sensation was normal to all modalities. Reflexes were absent in this extremity but normal elsewhere. There were several prominent veins in the arm and shoulder region. The radial pulses were equal but there was a difference in blood pressures of the two arms, the left was 110/85 and the right 122/72. The lungs had numerous râles. The heart was not remarkable.



Fig. 12 Case 4 Photomicrograph of tumor tissue removed from the spinal canal (Masson stain) $\times 260$

granular unencapsulated tumor invading the muscles overlying the right first and second ribs and there was destruction of the right second thoracic lamina. Furthermore there was a thin sheet of tumor extending part way across the exposed dura from the right side at the level of the second vertebra; this extension was obviously not thick enough to compress the cord nor had it extended far enough to involve nerve roots on the left. After the extradural extension of the tumor was removed the dura was opened and the posterior roots of the fifth cervical to the third thoracic on the right were cut. There was a tiny tip of the tumor presenting intradurally where the second nerve emerged.

The dura was closed and with the wound held apart with self retaining retractors and the skin and subcutaneous tissues protected with sheet lead 2,000 R units of roentgen therapy at 85 kilovolts were administered directly into the wound. Segments of the tumor were removed before and after therapy to be studied microscopically.

Histopathology of tumor tissue before and after roentgen therapy: (a) Before radiation (Figs. 12 and 13 a) The tumor: very cellular the cells large, compactly grouped and varying in size and shape. The cytoplasm is abundant and pale; the nuclei large, irregular, hyperchromatic with large deeply stained nucleoli. The cells are typically epithelial and mitotic figures numerous. There is little or no stroma and no structural arrangement of the cells.

(b) After radiation (Fig. 13 b) The general architecture is the same. The cells have a liquefied appearance apparently representing cytotoxicity. The nuclei of many of the cells are fragmented and mitotic figures on the whole are very much fewer. The stroma appears slightly greater and there are deeply stained lymphocytes throughout the stroma.

Diagnosis: An extremely malignant carcinoma of epithelial type (probably bronchogenic) showing definite effects from roentgen radiation. (Diagnosis by Dr. N. C. Foot, Department of Surgical Pathology.)

Recovery: from operation was prompt and the wound healed with perhaps a little more induration

than would be expected but without fluid or infection. There was no fever till the fifth day when the temperature rose to 104 then slowly fell to normal by the eighth day. This was interpreted to be a reaction from the roentgen therapy.

There was complete relief of pain. The entire right upper extremity of course was without all types of sensation. Because of lack of position sense the motions were at first poorly co-ordinated but he learned soon to watch motion made with the extremity and became fairly expert and accurate with it. An additional 4,000 units of roentgen therapy were given and the patient was discharged 4 weeks after operation.

Follow-up: Shortly after leaving the hospital he developed increasingly severe headache and vomiting with ensuing stupor and coma which was interpreted as the result of intracranial metastasis. No autopsy was performed.

After our experience with the previous cases we had learned to be on the lookout for the clinical syndrome that results from these apical tumors and no time was lost in making the diagnosis and anticipating the prognosis. A feature of this case not common to the previous ones was the early extension of the tumor into the supraclavicular space producing fullness there. He was having considerable pain when we saw him first and already required morphine for its control. Operative removal of the tumor was impossible and previous experiences with roentgen therapy had showed it to have little or no value in controlling pain.

The operation employed here served three distinct purposes: a sufficient number of sensory roots were cut to insure relief of pain, the laminectomy and removal of part of the extradural tumor served to avoid or at least to delay cord compression, and a larger initial dose of roentgen therapy could be administered through the open wound than could otherwise have been accomplished. The value of the first two cannot be doubted, the value of the last is questionable even though the histological sections showed the therapy to have been effective. The result of desensitizing an arm is not to be dreaded as much as one might think for this patient learned to accommodate in part for the loss of position sense.

CASE 5 (Ht. No. 150634) Constricting lesion of the esophagus presumed to be cancer and treated with roentgen ray. One year later pain in left shoulder and upper extremity; period of increased



Fig 15 Case 5 Photograph of autopsy specimen 1, Stricture of esophagus, site of healed neoplasm 2, Tumor mass, outlined by heavy dotted line, the inferior surface of the first rib is indicated by a fine dotted line and the tumor passes up through the arch of this rib 3, Tracheobronchial lymph node involved by metastasis 4, Part of thoracic sympathetic chain dissected from tumor 5, Brachial plexus

cation, and fenestration of aortic valves, patent foramen ovale, arteriolar nephrosclerosis, fibrous adhesions and pleural thickening of both pulmonary apices, fibrocalcified scar of left apex, calcified tuberculous nodules of both lower lobes, calcified tuberculous tracheobronchial lymph nodes, left, perisplenitis, chronic passive congestion of the liver, benign prostatic hypertrophy, hypertrophy of bladder, slight cystitis (Report from Department of Pathology, Cornell Medical College)

This case illustrates that occasionally a tumor at the thoracic apex will not produce a complete Horner's syndrome though in view of the findings at autopsy, no doubt myosis, ptosis, of the eyelid and enophthalmos would have appeared had the patient lived longer. The significance of the dilated pupil will be discussed hereafter.

The case also is an illustration of an unusual instance in which with roentgenotherapy the primary lesion disappeared leaving secondary carcinoma which failed to respond to the same therapy. While the existence of esophageal carcinoma was not verified by biopsy the clinical and roentgenographic improvement that occurred would seem to be sufficient evidence.

ANATOMY

The apex of the chest is a region that is infrequently pictured as an anatomical unit. For purposes of considering the mechanisms accounting for various symptoms and signs resulting from tumors here, some of the more important landmarks should be pointed out. The upper part of the thoracic cage narrows abruptly and the lung, in the confines of the



Fig 16 Case 5 Photomicrograph of the tumor at the thoracic apex. Note invasion by tumor cells of, 1, an arterial lumen and, 2, perineural lymphatics of a nerve (Hematoxylin-eosin) $\times 115$

The starch iodine sweat test showed diminished to absent sweating over the left side of the face, neck, upper thorax and upper extremity. Skin temperatures were 1 to 3 degrees higher in the left upper extremity. Routine laboratory tests were normal. Roentgenograms of the chest showed a diffuse shadow at the left apex extending into the soft tissues of the supraclavicular region. There was also an elevation of the left diaphragm but since the chest was not fluoroscoped it is impossible to say that this represents a phrenic palsy (Fig 14). No involvement of bone was observed.

During the period of observation he was seen to be suffering greatly from pain in the extremity even though he received a grain of codein every 4 to 6 hours. Morphine did relieve the pain for a short time on several occasions. Continued roentgenotherapy appeared to have no benefit. He developed a loose, non-productive cough and was losing weight.

Operation. Under avertin anesthesia with addition of small amount of ether a laminectomy was done from fifth cervical to third thoracic and the left posterior nerve roots of the fifth, sixth, seventh and eighth cervicals and first, second and third thoracics were cut. No tumor tissue was seen. The patient appeared to stand the operation well.

Bronchopneumonia developed in both lungs after operation and death occurred on the third post-operative day, March 22, 1938.

Autopsy (No 9236). The body was that of a well developed but rather poorly nourished man of 73 years. There was light puffiness of the left fore arm and hand and a firm mass was palpated in the left supraclavicular region. There was a recently healed surgical incision over the vertebral spine from mid cervical to mid thoracic region.



FIG. 14. Case 25. Roentgenogram taken about 7 months after the onset of illness showing diffuse shadow at the apex of the left chest.

In the mediastinum and neck the finding of interest was a firm tumor mass in the left infraclavicular region (Fig 15). This mass lay out side the parietal pleura in the paravertebral region and showed no tendency to extension anteriorly into the mediastinum. It was attached to the upper lobe of the left lung along its medial aspect by easily broken fibrous adhesions. It completely filled the area encircled by the first rib and incorporated in the mass were the sympathetic trunk, the nerves of the brachial plexus and the subclavian artery and vein. The tumor was closely adherent to the first two ribs particularly at the vertebral ends and to the sides of the bodies of the adjacent vertebrae. There was no direct connection of the mass with the esophagus. The cut section of the tumor showed white fibrous tissue in which were islands of pale yellow tissue and areas of anthracotic pigment the latter represented incorporated lymph nodes which had lost their identity. There were several lymph nodes in the mediastinum involved with tumor tissue but they were not in continuity with the tumor mass.

The pleural cavities contained 100 to 200 cubic centimeters of cloudy amber fluid and there were adhesions at both apices. The tumor at the left apex was attached to the pleural surface of the lung but it did not involve the parenchyma. Crepitation was almost absent in both lungs and replaced by a diffuse firmness. Sections showed a moist irregularly lumpy surface with a calcified scar at the left apex and numerous small calcified nodules in both lower lobes.

The esophagus at a point about 9 centimeters below the epiglottis was narrowed by what appeared to be a fibrous constriction of its wall. The lumen at this point was one half the size of the remaining lumen but the mucosa over the area was smooth and normal in appearance.

Microscopic examination of the tumor mass at the thoracic apex (Fig 16) shows a wild looking mass of epithelial tissue arranged in whorls of squamous cell containing pearl formations and prickly cells. Mitotic figures are present. Strands of this tissue are invading nerve sheaths and the walls of arteries. The tumor cells have not invaded parenchyma of the lung. Similar squamous cell growth infiltrates a lymph node from the mediastinum.

Microscopic examination of a section from the area of stenosis in the esophagus shows no tumor. There is a slight lymphocytic infiltration with some leucostasis in the lymph spaces and the connective tissue is increased.

The primary diagnosis included fibrous scar of esophagus with partial stenosis (x ray irradiation for carcinoma of the esophagus 1 year), squamous cell carcinoma of left infraclavicular region with involvement of the region of the left brachial plexus, sympathetic trunk and apical pleura, confluent bronchopneumonia of all lobes of both lungs, acute pleuritic tumor.

The accessory diagnoses included arteriosclerosis of thoracic aorta, abdominal aorta and of renal, splenic, iliac and coronary arteries, sclerosis calcifi-

plete clinical and pathological report of a case having a primary epithelial carcinoma of the pulmonary apex producing a "phrenicopupillary syndrome" with pain and paralysis of the upper extremity. They also cited an identical case reported by Ricaldoni in 1918. Tobias, in 1932, discussed the symptom complex produced by tumors of the thoracic apex and cited 5 cases, 4 of these were diagnosed primary carcinoma of the lung, 2 having had autopsies, and the fifth was proved at operation to be unsuspected gastric carcinoma metastasizing to the apex of the chest.

In more recent years (since Pancoast's last report in 1932 to January 1, 1938) cases singly or in small series have been reported, mostly in the literature of this country. Although a few, unrecognized under other titles, may have escaped notice an analysis of the cases (including the cases of my series) with similar clinical pictures and autopsy studies shows that 15 were carcinomas of the lung primary in the apex, 2 were squamous cell carcinomas of branchial origin; 1 was sympathoblastoma, 3 were epithelial carcinomas of unascrcribed origin, 1 was metastatic carcinoma from the pancreas; and 1 was metastatic from the esophagus. Eight other cases during the same period of time have had biopsies and in 5 a diagnosis of bronchogenic carcinoma was made.

Primary carcinoma of the lung. From these studies it is evident that the majority of cases have had their symptoms as a result of primary carcinoma of the pulmonary apex, the neoplasm having invaded the pleura and adjacent structures. There has been a notable hesitancy in admitting that the cell types found in some of these tumors at the periphery of the lung could be primary there. However, there is abundant and convincing proof that the cell type in carcinoma primary in the lung is not characteristic of any given level of the bronchial tree but is dependent upon the differentiation attained. Samson has further pointed out that "since all epithelia from the trachea to the terminal bronchioles (and possibly the alveolar lining cells) have the same embryological background, an equivalent potentiality in the production of neoplastic cell types should occasion no surprise." In the series under consideration all of the three funda-

mental cell types have been found, namely, the undifferentiated cell carcinoma, the adenocarcinoma, and the squamous cell carcinoma, the last has been most frequent.

An argument brought by Pancoast in 1932 against the pulmonary origin of these apical tumors was the lack of hilar, mediastinal, and pulmonary metastases ("intrathoracic metastases"). But of the cases shown at autopsy to have bronchogenic tumors at the apex, 33 per cent had involvement of mediastinal or hilar nodes. Thirty per cent was quoted by Miller and Jones in a study of 808 cases of primary carcinoma of the lung. It might be added that in this series of apical carcinoma, metastasis to distant organs occurred about as frequently as would be expected for bronchogenic carcinoma regardless of location in the lung.

Other epithelial tumors at the apex of the chest. It has not been a simple matter in many of the reported cases for the authors to decide that an epithelial tumor, even when completely exposed at autopsy, arose from the lung and spread to adjacent tissues instead of from outside tissues to the lung. Biologically carcinoma represents a single disease and there is often no way of tracing its histogenesis absolutely. Clarke (before the American Association of Pathology) reported the detailed autopsy findings of a case "with the clinical findings described by Pancoast." Grossly the neoplasm involved the apex of the lung and the adjacent structures in the thoracic apex. It was an epithelial carcinoma which he stated could possibly be primary in the lung but could also possibly be derived from a bronchogenic "rest", he could see no way of establishing the correctness of either diagnosis. The sections of the tumor had been submitted to Ewing, Mallory, and Wolbach and although all had agreed upon its epithelial nature they disagreed upon its origin. No doubt others have unhesitatingly called similar tumors bronchogenic neoplasms.

Two cases of squamous epithelial tumors existing in the thoracic apex, depressing the lung but not actually invading it, have been reported by Fried (11). The tumors had involved adjacent vertebrae, ribs, and nerves, producing symptoms and signs essentially the same as do the bronchogenic tumors with the



Fig 17 Diagram of an anatomical preparation showing region invaded by a tumor at the left thoracic apex. The clavicle and sections of the subclavian artery and vein have been removed. The apex of the lung together with parietal pleura are depressed with a retractor. The cervical nerves to the brachial plexus (fifth sixth seventh and eighth cervicals) are seen emerging from their intervertebral foramina. The first and second thoracic nerves are also seen. The exposed sympathetic chain from below upwards shows the second thoracic ganglion the first thoracic ganglion the inferior cervical ganglion and the mid-cervical ganglion with their respective rami.

first ribs, takes on a pyramidal shape the apex of which protrudes for a short distance into the base of the neck. The boundaries of this opening in the thoracic apex through which lung and parietal pleura protrude are the U shaped first rib the body of the first thoracic vertebra and the superior mediastinum. The subclavian artery and vein and the lower nerves going to the brachial plexus (cervical 8 and thoracic 1) arch over the pleura as they pass laterally, the remaining nerves forming the brachial plexus are in close proximity. With the pleura and lung retracted from the vertebral ends of the upper ribs (Fig 17) the first two intercostal nerves may be seen to emerge from the intervertebral foramina and the thoracosympathetic ganglionic chain lies on the surface of the bodies of the vertebrae

just anterior to the heads of the ribs. This chain is connected to the various spinal nerves by small rami and it extends on up into the neck as the cervical sympathetic chain. The important structures of the superior mediastinum such as the great vessels trachea esophagus, phrenic and recurrent laryngeal nerves, are also to be kept in mind. Obviously a comparatively small tumor may involve a large part of the structures confined in this area and produce widespread manifestations of its presence.

PATHOLOGY

A consideration of the various types of neoplasm that can occur at the apex of the chest producing the clinical picture under consideration requires a review of the literature. In his first paper in 1924 Pancoast (26) thought he was dealing with an endothelioma of the pleura, 2 of the cases had had biopsies but none had had postmortem examination. Henderson in 1930 no doubt influenced by this attitude, reported 3 cases without autopsy and mentioned 5 others all of which were diagnosed pleural endotheliomas. Since then no case of pleural endothelioma of the apex has been reported although the possibility of this diagnosis is often considered differentially. Pancoast (27) later refuted his previous stand when, in 1931, he declared that a review of the slides of one of his original cases showed 'spinocellular carcinoma'. He reasoned, after encountering 4 more cases with identical clinical and roentgenographic features, that neither pleural endothelioma nor primary carcinoma of the lung would more than rarely produce this clinical picture. He suggested therefore that the tumor as a distinct entity might take its origin in an embryonal epithelial 'rest' similar to those producing bronchogenic carcinoma. It is difficult to say why he took this final attitude in view of the fact that in none of his cases was autopsy done and in only 7 were biopsies made. However he wisely added it is possible that this new designation may be changed again with better knowledge of the histopathology of the growth.

With the interest aroused in cases of this type other studies have come to light. Courcort and Lereboullet in 1931 had given a com-

vertebral structures before producing mediastinal symptoms

Other possible tumors of the thoracic apex. It is possible to postulate innumerable kinds of tumors in this region. Certainly secondary malignancy from distant neoplasms must always be kept in mind. Tobias's case of unsuspected secondary gastric carcinoma, a case mentioned by Evans of secondary carcinoma from the breast 8 years after mastectomy, and Case 1 of metastasis from the pancreas are examples of this. Such lesions as aneurisms of the subclavian artery, lipomas, chondromas, sarcomas of vertebræ or ribs, and inflammatory tumors have been mentioned, but no cases of these rarer possibilities have come to light in the literature

SYMPTOMATOLOGY

The tumors that occur most frequently in the thoracic apex are those that characteristically appear in middle life. Of 50 cases with varying types of neoplasm included in this study the average age was 57 years, the youngest 30, and the oldest 73. Only 4 were women. The right side was involved a little more frequently than the left.

The outstanding symptoms of these tumors have been those due to irritation or damage to the upper intercostal nerves, the brachial plexus, and the thoracocervical sympathetic ganglionic chain. These symptoms in one form or another have been almost without exception the first to appear and the most prominent throughout the course of the illness. Cough has been present in less than half of the cases; when present it has frequently been non-productive and has not appeared until the disease was well advanced. A few have had bloody sputum but only one developed massive hemoptosis. Encroachment of the tumor upon the subclavian and jugular veins has sometimes resulted in distended veins and edema of the neck, shoulder girdle, or upper extremity, similar encroachment upon the subclavian artery has produced diminished amplitude of the pulse and lower blood pressure in that extremity. A few patients have complained of symptoms such as dyspnea, dysphagia, and hoarseness when the tumor has compressed structures of the

mediastinum. Loss of weight in the early stages of the disease has usually been moderate or unnoticed, but in the later stages there is increasing weakness and loss of weight, not infrequently advancing to an extreme emaciation. The unbearable pain of the disease with loss of appetite no doubt contributes to this terminal state of malnutrition. In addition, of course, various symptoms may occur as a result of the existence of the tumor in other organs.

ANALYSIS OF NEUROLOGICAL SYMPTOMS AND SIGNS ON THE BASIS OF THE NERVOUS STRUCTURES INVOLVED

The neurological symptoms and signs are the most important part of the clinical picture of tumors of the thoracic apex. A glance at Figures 11 and 17 will serve as a reminder of the relative locations of the important structures that are damaged from compression or actual perineural invasion by neoplasms in this region.

Pain. Pain, which has almost always been the first symptom of the disease, is said to have begun in the region of the scapula or "shoulder" in half of the cases. In the other half it began in the front of the upper chest, the axilla, the inside of the arm, the ulnar side of the forearm or in various combinations of these areas. One of the distinctive features of the pain, however, is that at the outset it is not likely to cover a large area, nor is it at first radiating, but it is more inclined to exist in a rather limited area. The original pain is both deep and superficial and variously described as boring, burning, stinging, gnawing, deep-seated, knife-like, or shooting. More often it comes in paroxysms which may be induced by general physical exertion, motion of the shoulder or coughing; in others it is constant from the start. Some authors have stressed the point that it is worse at night but this can be said of almost any persistent pain.

Pain in any of the sites mentioned is indicative of irritation of definite spinal nerves or their branches. Occasionally pain in the shoulder may result from pressure upon the phrenic nerve. In the scapular region it may be the result of one or more possible mecha-

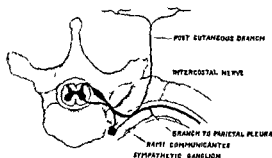


Fig. 18. Diagram showing the components of a thoracic spinal nerve

possible exception that these two tumors extended anteriorly as well as posteriorly and invaded the sternoclavicular joint. This may be a minor or valueless differential point but none of the tumors reported as bronchogenic had this characteristic. Fried called the tumors 'branchiomas', indicating that they arose from epithelial remnants of branchial clefts. Since there are normally no epithelial elements in that region the rationale is convincing. Kelman and Schlezinger also Graef and Steinberg reported 2 additional cases of epithelial carcinoma which merely depressed the apex of the lung without invading it although these authors were loath to designate the origins. In Fried's cases there were no distant metastases whereas in the last cases there were.

There is always the possibility that epithelial tumors in this region may be metastatic from primary lesions in the nasopharynx, oral cavity, submaxillary gland, sublingual glands, thyroid, parathyroid, carotid body, thymus, bronchi, or esophagus. Case 5 is a good example of how metastasis from one of these structures can produce a clinical picture like that produced by any other apical tumor. It is rather surprising that more cases of this kind have not appeared in the literature although the reason is doubtless due to the fact that metastases from a known primary lesion occasion little difficulty in differential diagnosis. Yet there are frequently instances of small neoplasms particularly in the nasopharynx that go unrecognized as the source of extensive metastasis in the neck and elsewhere.

Any primary neoplasms of this kind may easily be overlooked even at postmortem.

Neurogenic tumors. Tumors having their origin from the various elements that compose the somatic and sympathetic nerves and ganglia of the chest are receiving increasing recognition. A discussion of their etiology and genesis is beyond the scope of this discourse and the subject has recently been reviewed by Andrus and by Foot of this clinic.

A case of intrathoracic sympathoblastoma 'producing the symptomatology of a superior pulmonary sulcus tumor' has been fully reported by Frost and Wolpaw.¹ The tumor had invaded the apex of the lung, adjacent ribs, and vertebrae and its gross features were no different from those presented by the more frequently occurring bronchogenic carcinomas in this region. The sympathoblastoma is a comparatively rare tumor in the chest. Most frequent neurogenic tumors here are the neurofibroma, the ganglioneuroma, and the neurosarcoma (or Schwannoma), while often benign they are likely to become malignant. Case 2, which unfortunately lacks postmortem studies, is a good example of a malignant neurosarcoma. Undoubtedly occasional cases presenting the syndrome of Pancoast will be found to possess benign or malignant neurogenic tumors.

Mediastinal tumors. While the clinical phenomena associated with tumors exclusively in the upper mediastinum are distinctive and unlike those encountered with tumors exclusively in the apex of the chest, the distinction is not so sharp when either becomes invasive. The bronchogenic carcinomas of the apex frequently produce symptoms from mediastinal compression or invasion. On the other hand, Browder and De Veer included in their series a case of thymic carcinoma¹² in which the early clinical developments were those of a tumor of the thoracic apex even though the roentgenographic appearance in the early stages was not characteristically that of a mediastinal tumor. Most of the neurogenic tumors would be properly grouped as mediastinal but they lie in the posterior mediastinum and these growths commonly involve para-

¹² The case had been previously mentioned as a neurosarcoma by Irving Cline's paper.

forearm and hand have been the usual sites

Palsy, atrophy, and reflexes Weakness and atrophy of muscles of the extremity are important signs in this syndrome. Rather early in the illness patients notice weakness which characteristically is manifest first in the hand grasp and in fine motions of the fingers but which later involves more and more of the extremity until complete paralysis may ensue, although this does not usually happen. It has been confusing to find marked weakness sometimes long before atrophy has appeared and without reflex changes. In some, the pain associated with muscular activity has no doubt diminished the vigor of voluntary motions. Atrophy is most prone to appear first in the small muscles of the hand, later it may be evident in the entire extremity. Since the lower nerves (eighth cervical and first thoracic) forming the brachial plexus are characteristically the first to be involved, the first signs of atrophy are seen in the hypothenar and interosseous muscles that these nerves innervate. Fibrillary twitching of the muscles of the extremity present, no doubt, at some stage in all cases has been infrequently mentioned. The state of the reflexes also has been referred to by comparatively few, impairment or absence of wrist jerks has accompanied some of the cases, and diminished triceps and biceps as well, in a few of the more advanced ones.

Manifestations of irritation and destruction of the sympathetic chain Horner's syndrome has been considered to be an early and essential finding in the diagnosis of tumors in the thoracic apex. This syndrome is one of paralysis and results from destruction to the thoracocervical ganglionic chain at or above the first thoracic sympathetic ganglion. Horner's syndrome strictly includes homolateral ptosis of the upper eyelid, myosis, enophthalmos, with anhydrosis, and flushing of the face. But it seems that too little attention has been given to less spectacular sympathetic phenomena which doubtless often antedate the complete Horner's syndrome. In many cases, particularly in early stages, irritative sympathetic phenomena must have been present as they were in 3 of my cases. Also, although a few observers besides myself have noted absence of sweating of the neck

and face prior to the ocular signs, the real significance of this is not generally understood.

Preganglionic fibers enter the sympathetic chain via white rami from each thoracic nerve, there are none from the cervical nerves. Postganglionic fibers pass via gray rami, not only back to the intercostal nerves, but also to all the nerves of the brachial plexus. Other fibers ascend in the cervical chain and are given off at higher levels.

In the past it has been taught that preganglionic fibers having vasomotor, sudomotor, and pilomotor functions in the face, neck, and extremity, come from the first, second, third, and fourth thoracic segments of the cord, also (20) that the special fibers to the eye come from the first and second segments. In man it has been my observation, and that of others (29), that when *all* the central connections of the upper thoracic chain have been cut, except the first thoracic preganglionic fibers, there is homolateral loss of sweating in the upper chest, axilla, upper extremity, neck and face, but no change in the eye and no flushing of the face. This means that before a complete Horner's syndrome can develop it is necessary to destroy the sympathetic chain at or above the first thoracic ganglion. Thus, it is an easy matter to account for anhydrosis of the face without ocular changes in a number of cases with apical tumors. Since a majority of the tumors under consideration impinge first upon nerves below the first thoracic it is likely that sympathetic paralysis without ocular signs is present early in the disease. But unless such paralysis is deliberately looked for it may be missed. The simplest and surest test is the starch-iodine sweat test.

While sympathetic paralysis is a rather common clinical phenomenon, sympathetic stimulation or irritation produced by inflammation or a compressing tumor, is not, in fact, its occurrence is categorically denied by some. However, a number of reliable observers have noted a dilated pupil on the side of active apical tuberculosis and in one of the cases of apical tumor in this study (Tobias) "Horner's syndrome had been preceded by signs of sympathetic irritation." From Cases 1, 3, and 5 I wish to point out

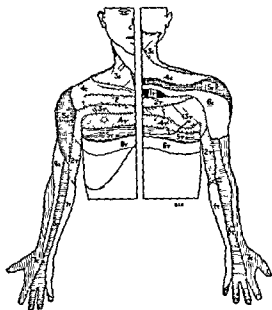


Fig. 19 Diagram (adapted from Head) showing the relative segmental sensory areas of the neck, upper extremities, and upper chest

msms (Fig. 18). First there is the likelihood that this initial pain in many cases is from irritation of the parietal pleura. The visceral pleura is insensitive but the parietal pleura is richly supplied with fibers from the intercostal nerves and stimuli arising in the parietal pleura produce surface pain which has a corresponding segmental distribution. This is a type of referred pain and is spoken of as a "pleurocutaneous reflex." Thus apical tumors impinging on parietal pleura might be expected to be accompanied by pain in cutaneous areas principally in the scapular region, first, second, third, and fourth thoracic. Other possibilities in the production of this pain are the direct irritation of one or more upper thoracic nerves as they emerge from their intervertebral foramina or less plausible, the direct irritation of posterior cutaneous rami of these spinal nerves.

The areas of distribution of the individual spinal nerves in the skin vary considerably and overlap each other. Figure 19 is a modification of one of the most frequently accepted diagrams of the distribution. The diagram indicates the spinal nerves involved when

pain appears in areas other than the scapular in the anterior upper chest (second, third, and fourth thoracic), the axilla (third and fourth thoracic), the inner aspect of the arm (second thoracic), the ulnar side of the forearm (first thoracic), etc. The various sensory areas of the axilla, arm, and forearm are actually supplied by distinct nerves, such as the medial brachial cutaneous and the medial ante brachial cutaneous but it is the irritation of the various components of these peripheral nerves usually in or near their intervertebral foramina, that produces the segmental pain.

As the disease progresses, pain almost always increases in its severity and frequency until it becomes an unbearable constant distress requiring opiates for relief. A typical protective posture to avoid increasing the pain is a tilting of the head toward the shoulder and fixation of the extremity in close adduction and flexion against the chest. The pain also gradually increases in its extent. In the bronchogenic neoplasms particularly, one can frequently follow the advance of the growth by the appearance of pain in successive areas. For example in Case 3, the pain began in the upper chest and scapular region (third thoracic), it later involved in succession the inner aspect of the arm (second thoracic) and the ulnar side of the forearm and little finger (first thoracic). In some cases the disease involves all the nerves to the brachial plexus (fifth cervical to first thoracic) and may encroach upon nerves coming from the cervical plexus. If the latter occurs, the patient experiences pain in the side of the neck extending up to the jaw or behind the ear and he may develop a protective attitude of the head like that of torticollis.

Paresthesias and sensory changes. Sensory phenomena of some kind have occurred in over half of the patients studied. The paresthesias have been largely in the extremity and include such subjective sensations as tingling, pins and needles, coldness, heaviness, dead feeling, etc. Hyperesthesia has been present in many so that light touch, the pressure of clothing, even a light breeze on the sensitive area has been extremely disagreeable. Fewer have had demonstrable impairment or loss of sensation but when present the ulnar side of

Early diagnosis may be much more difficult. The symptom of pain, usually having a segmental distribution, may be present for weeks or months before symptoms or signs develop sufficiently to allow a diagnosis. A careful neurological examination including tests for sympathetic nerves in these early stages is extremely important. Changes in percussion, fremitus, and auscultation have frequently been entirely absent at the apex until the last stages of the disease.

Roentgen examination The typical findings that one might expect would be the presence of a dense shadow at the pulmonary apex and destruction of adjacent ribs and vertebrae. These features were originally pointed out by Pancoast as findings necessary to the diagnosis, but experience has shown that often there has been an unnoticed or an insignificant looking apical shadow present until quite late in the course of the disease. The most frequent mistake has been to make a diagnosis of fibrosing apical tuberculosis from the appearance of the roentgen plates. Of course, in the later stages of all cases the tumor casts a more convincing shadow, but even then the appearance of the shadow cannot be relied upon to indicate the kind of tumor that is present. Destruction by erosion or invasion, of the upper ribs or portions of the lower cervical and upper thoracic vertebrae, has been present in more than 90 per cent of the cases. In some of these cases, however, destruction of bone was not demonstrated till very late in the disease while in others it was seen only at autopsy. Perhaps the most characteristic finding in this respect has been destruction of the vertebral ends of one or more of the upper four ribs (second rib most often). Deviation of the trachea and esophagus, widening of the mediastinum, intrapulmonary metastases, and elevation of the diaphragm are some of the other signs to be looked for on roentgenograms of the chest, incidentally, pleural fluid has not been a feature of the cases of this series.

Differential diagnosis There is probably no way of reliably distinguishing between the various kinds of neoplasms that may occupy the thoracic apex except by biopsy and even then, as past experience has shown, the micro-

scopic examination may show an epithelial neoplasm, the origin of which is indeterminate without a necropsy examination. But in only rare instances will the differentiation of the kind of neoplasm be of any ultimate significance in the course of the disease. It is of much greater importance, particularly in the early stages, to differentiate other diseases which may be confused with neoplasm here.

Tuberculosis in this region can reproduce, at least in part, many of the signs and symptoms of a neoplasm. Even more confusing is the fact that both fibroid and active tuberculosis have been found in conjunction with neoplasms of this series and the suggestion has been made (Fried, 10) that tuberculosis may be a predisposing factor not only in the origin but in the direction of extension of the tumor.

Inflammatory, degenerative, or neoplastic diseases of the lower cervical and upper dorsal cord may reproduce any or all of the neurological manifestations of apical neoplasms, Pancoast's very first case was explored by Frazier and Spiller for a cord tumor.

Authors have mentioned many other diagnoses made in their cases particularly in the early stages of the disease. A few of those commonly mentioned are cervical rib, brachial neuritis (traumatic or inflammatory), arthritis of the spine or shoulder, myositis and bursitis of the shoulder.

PROGNOSIS

Since the cases reported as having the clinical syndrome under discussion have so far all had malignant neoplasms at the thoracic apex, mortality is 100 per cent. However, it is probable that occasionally a benign tumor (most likely neurogenic) will be cured by surgery and because of this a biopsy of the tumor is always desirable. The period of survival after the onset of pain in this series has been between 5 and 24 months, averaging about 14 months.

TREATMENT

Although the survival period has been comparatively short in this condition it is a very long time for a patient to suffer the bitter pain present in almost every instance

what I believe are manifestations of sympathetic irritation (a) In Case 1 the patient was frequently found to have a well demarcated area over the inside of the arm from axilla to a point just below the elbow where there was prominent goose flesh and beads of sweat, since these phenomena were so striking and had a segmental distribution (second thoracic) there seems little doubt of their significance (b) In Case 3 a somewhat comparable phenomenon appeared when the patient was under emotional stress. At such times he developed a well localized area of profuse sweating and blanching in the center of an area of anhidrosis (c) In Case 5 there is the patient's frank story that he had a period of excessive sweating of one side of the face, neck, and extremity. On admission he was found to have anhidrosis of these areas representing sympathetic paralysis coming after a period of sympathetic hyperactivity. It will be remembered that this same patient also had a dilated pupil on the side of the lesion and it is tempting to consider it as a further manifestation of direct stimulation of the sympathetics. But a more plausible explanation suggests itself, namely that it is a ciliary reflex comparable to that produced by pinching the skin of the neck. However this does not absolutely preclude the possibility of direct sympathetic stimulation and mydriasis.

Phrenic and laryngeal nerve palsy. While it is necessary for the tumor to exert mediastinal pressure before these two nerves are injured paralysis of the diaphragm or hoarseness has been mentioned in a few cases.

Cord compression. A number of authors have stressed the fact that neoplasms of the thoracic apex tend to grow into the intervertebral foramina and compress the nerves as they emerge. But few have been impressed with the frequency with which the tumors extend on through the foramina and expand into the spinal canal to compress the cord, producing loss of sphincter control and loss of sensation and motion below that level. Extension of this sort occurred in Cases 2 and 4 (Fig 11). In an analysis of the reported cases, there was complete or partial compression by symptom or by autopsy finding, in about 20 per cent of the cases. The descrip-

tive term "hour glass" or "dumbbell" has been applied to tumors that have an intraspinal and extraspinal enlargement connected by a narrow process which joins them through an intervertebral foramen or through an interlaminar space. Heuer in a study of 'So called Hour glass Tumors of the Spine' found 37 cases implicating the dorsal cord neuromas, neurinomas, neurofibromas, fibrosarcomas, ganglioneuromas, and chondromas all had about equal incidence. None reproduced the exact group of symptoms under consideration here but that is because none of the tumors in his series occurred high enough in the thorax.

Intracranial metastases. Since the majority of neoplasms at the thoracic apex are bronchogenic, comparatively frequent intracranial metastasis might be expected. Miller and Jones state an incidence of 9.5 per cent in 808 cases of bronchogenic carcinoma. However in the 50 cases of this study only 3 were found to develop clinical manifestations of intracranial metastasis, none was found in the few cases in which a postmortem examination of the brain was carried out.

DIAGNOSIS

When the tumor is large and the signs are well advanced, recognition of the presence of a neoplasm at the thoracic apex should not be difficult. Complete Horner's syndrome, anhidrosis of the upper extremity and upper chest, palsy, atrophy and sensory changes of the extremity, the physical and roentgenographic evidence of a mass at the apex and various other secondary manifestations, all produce a striking clinical picture. At least two thirds of the cases have had palpable and sometimes tender masses in the supraclavicular region, in occasional cases extension of the tumor has been palpable in the back, in the anterior chest wall or in the anterior infraclavicular space. Distended veins in the neck, extremity and chest wall or edema of the extremity or supraclavicular space have been mentioned in 20 per cent of the cases. Diminution of blood pressure and pulse in the extremity is rarer. Clubbing of the fingers has been noticed rather infrequently considering the nature of most of the tumors.

carries with it certain serious hazards, and it may not afford complete relief of pain

Multiple posterior root section is not a particularly dangerous operation, if enough roots are cut complete relief of pain will result; at the same time that the cord is exposed any intraspinal extension of the tumor can be removed and wide laminectomy done to avoid cord compression. While a completely denervated upper extremity is largely useless, it is a small price to pay for being spared untold pain. I can see little or no advantage in combining chordotomy and root section.

Finally, the plea for early recognition and decision in these cases is prompted by the fact that it is eminently unfair, not only to the patient but to the surgeon, to propose operation only after the patient becomes emaciated and has developed morphine addiction.

SUMMARY

1 Five cases having different tumors at the apex of the chest are described. The symptoms and signs are more or less alike and conform to the clinical picture originally described by Pancoast

2 The literature dealing with "apical neoplasms" and "superior pulmonary sulcus tumors" has been reviewed. The anatomical, pathological, clinical, and therapeutic aspects of the entire group have been summarized and briefly evaluated

3 Special emphasis has been placed upon the neurological manifestations of tumors at the apex of the chest

4 A plea is made for early recognition of these tumors and for intelligent treatment

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The early pain requires increasing doses of codein, but this is usually soon supplanted by increasing doses of morphine which in many cases has failed to provide complete relief.

Röntgen or radium therapy has its place in the treatment of these neoplasms and it has been utilized in the majority of the cases. But few if any cases have shown regression of the tumor even with large doses and as for the effect on pain a very few have had partial and short lived benefit.

Paravertebral alcohol injections were tried without success by Marcl and Crawford. Surely it would be undesirable to inject alcohol accidentally into tumor tissue and, more often than not, tumor impinges on nerves proximal to the site where alcohol can be injected.

Operative results Surgical experiences with these tumors, other than simple supraclavicular biopsy, may be profitably listed.

1 Exposure of the tumor through a posterior paravertebral approach but without attempted removal—6 times (Pancoast's 3 cases, Cases 1, 2, and 3 of author's series).

2 Exposure of the tumor through a posterior approach with attempted removal, attended by severe hemorrhage contributing to postoperative death (Jacox's case 17).

3 Exposure of the tumor through a posterior approach and subtotal removal leaving mediastinal and cervical extensions. Death on third postoperative day (Stein's case).

4 Supraclavicular exploration with negative findings (Case 1 of author's series).

5 Supraclavicular exposure with division of the clavicle. Partial removal of the tumor but abandoned because of patient's pain 'due to involvement of the spinal nerves within the intervertebral foramina' (Browder and De Veer's case).

6 Supraclavicular exploration. No visible tumor but lower brachial plexus found to be elevated and anterior scalene muscle cut. Temporary relief of pain (Browder and De Veer's case).

7 Supraclavicular exposure of inoperable tumor. Section of edematous anterior scalene muscle. Partial relief (Browder and De Veer's case).

8 Chordotomy—3 cases. (a) High chordotomy done late in course of the disease. No

mention of the results (Pancoast's case). (b) Chordotomy at third cervical segment (Jacox's case). Personal communication from Dr Jacox states that patient had return of pain before death. (c) Chordotomy below the fifth cervical root gave "more comfort and considerably less pain" (Stein's case).

9 High chordotomy combined with section of posterior roots—2 cases. (a) Chordotomy at third cervical segment with section of third, fourth, and fifth cervical roots. No remark about result (Kelman and Schlegler's case). (b) Chordotomy at third cervical segment with section of fifth, sixth, and seventh cervical roots. Extradural tumor tissue was noted at lower end of exposed dura. Patient had considerable pain during postoperative course and died within a month (Jacox's case, 18).

10 Section of multiple posterior roots—3 cases. (a) Unilateral section of posterior roots of first, second, third, and fourth thoracics. Incomplete relief of pain (Case 1 of author's series). (b) Unilateral section of posterior roots of fifth, sixth, seventh and eighth cervicals and first, second, third, and fourth thoracics. Also partial removal of intraspinal extension of tumor. Complete relief of pain (Case 4 of author's series). (c) Unilateral section of posterior roots of fifth, sixth, seventh and eighth cervicals and first, second, and third thoracics. Death from pneumonia on third postoperative day (Case 5 of author's series).

Deductions concerning treatment. Since malignant neoplasms of the thoracic apex are incurable, effort should be made to relieve the severe pain accompanying them. Morphine is often found to give incomplete relief even in large doses and drug addiction is an undesirable state. Röntgenotherapy has little to recommend it. Alcohol injections are impracticable and sure to fail. The prognosis should be anticipated early in the patient's illness and suitable surgical measures should be taken to assure him comfort. Any surgical procedure other than chordotomy or multiple root section is of no value. In choosing between chordotomy and multiple root section it must be remembered that chordotomy to be effective must be done above the fourth cervical segment. This is a procedure that

carries with it certain serious hazards, and it may not afford complete relief of pain

Multiple posterior root section is not a particularly dangerous operation; if enough roots are cut complete relief of pain will result; at the same time that the cord is exposed any intraspinal extension of the tumor can be removed and wide laminectomy done to avoid cord compression. While a completely denervated upper extremity is largely useless, it is a small price to pay for being spared untold pain. I can see little or no advantage in combining chordotomy and root section.

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THE INTERPRETATION OF LOWER SPINE INJURIES

With Special Reference to Spondylolisthesis and Spondyloschisis

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THE accurate interpretation and the proper evaluation of the findings in the lower spine following an injury are very difficult, even when one has had much experience. When the injury has been serious and one finds definite evidence of fracture, the problem of interpretation is relatively simple, and the associated clinical symptoms will be helpful in the evaluation of the damage done. The greatest difficulty, however, occurs in that group of cases in which there has been a relatively slight trauma and in which some one else is presumed to be responsible for the accident. The interpretation becomes especially difficult when the history shows that after a relatively slight traumatism the patient goes about for a time in much the same manner as usual, then after days or weeks especially after consultation with lawyers, he begins to complain of symptoms which seem to grow progressively worse. In such cases the history not uncommonly reveals that the patient was able to carry on his usual occupation which may have been a laborious one with no symptoms preceding the accident but some time after the accident he suffered much pain much inconvenience and was unable to resume his occupation.

A thorough roentgen examination of the spine in such a case may reveal a very definite and positive displacement of a vertebra with suggestive evidence of fracture which is indicated by a decrease in the depth of the anterior portion of the body of the vertebra and which may be interpreted as a compression fracture. It is true, however, that the patient may have the same symptoms and yet an ordinary anteroposterior film may show nothing abnormal. (One should never depend upon an anteroposterior film alone in an examination

of the spine.) Under such circumstances, it is most difficult for the roentgenologist or the surgeon to interpret and place a proper evaluation upon the effects of the recent injury.

From the roentgenologist's standpoint the first essential is a set of good films, which have been taken to bring out especially the affected vertebra. The minimum number of films required are: an anteroposterior view made on a Potter Bucky diaphragm, a direct lateral view, and an oblique anteroposterior view of each side of the spine, so arranged as to demonstrate the pedicles and the articular processes. These oblique films are best made at an approximate angle of 45 degrees, with the rotation first toward the right and then toward the left, as emphasized by Hubeny, Ghormley and Kirklin and Morton. After these preliminary films it may help to concentrate the field of observation directly over the affected vertebra.

Interpretation of these films demands the greatest amount of detailed study. Each line in the roentgenogram produced in the vertebra above and below should be compared with those found at the site of injury. In the anteroposterior view, the outlines of the articular processes and the joint space between them should be carefully traced out. The oval shadow of the pedicle shown in the anteroposterior view should be compared and studied in detail as has been particularly emphasized by Steiner. Schinz has published a fine illustration, No. 1036, page 639, in his excellent book¹ which shows a fracture extending directly through this process, thus making a break in the oval outline. Following injuries a careful study of the bone structure and the intervertebral discs is imperative for we believe that the intervertebral disc rarely will show pathological changes roentgenograph

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¹Schinz, Baertrich, Friedl: *Lehrbuch der Röntgendiagnostik*, 3. Auflage, 1. Band, p. 639, Leipzig, Georg Thieme, 1932.

ically immediately after an injury Therefore, we believe that the presence of such changes indicates that some pathological process had previously been present Steiner says, "Isolated fractures of the arch are quite rare" He has, however, published illustrations of such fractures. The differentiation of a fracture from a developmental neural arch defect will depend chiefly upon a careful study of the line of separation. A fresh fracture is apt to show a jagged, sharp line, and an old fracture should show either callus or absorption of the edges and the elimination of sharp lines, or it should show a sclerosis incident to repair In a neural arch defect, however, these changes are absent and would involve difficulty in interpretation only provided the first examination was made a long time after the injury

The most difficult cases of lower spinal injuries to interpret are those in which roentgenographic examination shows some compression or decrease in the depth anteriorly of one of the vertebrae If this is associated with a spondylolisthesis and if there are also found bone changes which are more marked than could be expected to occur within the time between the injury and the x-ray examination, the difficulties involved are extraordinary Mitchell says, "Trauma in some form is always the actual exciting cause in spondylolisthesis, but in a few cases only is the condition entirely traumatic in origin The predisposing causes of the condition are

"1 Unilateral or bilateral defects in the neural arch of the last lumbar vertebra, especially between the superior and inferior articular processes (spondyloschisis interarticularis congenita arcus vertebralis-Neugebauer)

"2 Fracture of the superior sacral or lowest lumbar articular processes

"3 Absence or asymmetry of the lumbosacral articular processes

"4 Increased obliquity either of the sacrum as a whole or of its superior articular facets

"5 Pressure deformity of the last lumbar vertebra as a result of prolonged strain

"6 Pathological processes affecting bones, joints, or ligaments at the lumbosacral junction Most modern writers, however, do not classify lumbosacral pathological dislocations as cases of spondylolisthesis"



Fig 1 Roentgenogram of a fourth lumbar vertebra, of a $5\frac{1}{2}$ months fetus, furnished to us by the courtesy of Dr Mollie Geiss The illustration has been enlarged to five times the anteroposterior diameter of the vertebra The actual vertebra measured a half inch This illustration has been enlarged to $2\frac{1}{2}$ inches This shows 1, a center of ossification for the body, and on the right side, 2, a center located in the region of the superior articular process, 3, a center which seems to form the posterior portion of the neural arch It will be noted that, on the right side, there is cartilaginous union between these two points On the left side, there appears to be a center of ossification comprising the entire arch The right and left segments of the arch have not united to form the spinous process 4, Isthmus—interarticular process—the usual site of non-union

The traumatism to which Mitchell refers we believe may be a long continued, repeated, slight trauma or strain, occurring in the course of an ordinary heavy occupation If this were not true, one could not find the bone structure changes that are present in the roentgenogram and which may be found almost immediately after the accident

Spondyloschisis All authors agree that interarticular neural arch defects (spondyloschisis) of one of the vertebrae are by far one of the most important predisposing factors These defects may be unilateral or more often bilateral, and are probably developmental in origin The neural arch develops usually and normally from one center of ossification on each side, but more than one center may be present If these separate centers do not unite to form a bony arch a defect develops and as a consequence, the vertebra lacks the support



Fig 2 Case 1 Courtesy of Dr Joseph R Post Lateral view Tracing and roentgenogram of the second third fourth and fifth lumbar vertebrae The spinal column including the fourth lumbar vertebra has slipped forward in relation to the fifth approximately 1 centimeter The accident occurred on May 8 1935 The first roentgenogram was made on July 11 1935 This roentgenogram was made January 15 1937 There was no appreciable difference in the roentgenogram made July 11 1935 and the one on January 15 1937 Notice that the anterior surface of the body of the fifth lumbar vertebra has been rounded off such as would occur from years of usage The arrow points to the defect in the interarticular process

that is given by the articular process which then permits the body to slip forward It is said that such defects may occur anywhere in the spinal column, but the great majority occur in the third, fourth and fifth lumbar vertebrae

Willis studied 748 spinal columns and found this condition in 57 (7.3 per cent) as follows Unilateral in 15 bilateral in 42 54 males 3 females The first lumbar was involved in 1 the third lumbar was involved in 1 the fourth lumbar was involved in 5 the fifth lumbar was involved in 45 and the sixth lumbar was involved in 5

Turner and Tchirkin studied 748 spines A separation of the neural arch was found in 31 or 4.28 per cent In 2, it was bilateral With two exceptions, the anomaly was found in the last presacral segment They found more anomalies in those specimens which contained 25 presacral segments (instead of the usual 24) They also found that in those cases which had 25 presacral vertebrae the lumbosacral disc is characteristically thinner than the average or than the other discs in the same

patients Of the 31 cases studied by these authors 30 were males and 1 was a female The incidence did not increase with age, a fact which indicates that the condition is definitely congenital George and Leonard have found this condition in children as young as 7 years of age and they have published the illustration of a patient with a spondylolisthesis of the fourth lumbar vertebra Shore found these defects in 6 per cent of Bantu native skeletons, Stewart in 27.4 per cent of Eskimo skeletons, and Mitchell found them in 3 per cent of European skeletons All authors agree that the fifth lumbar vertebra is the most commonly affected

Spondylolisthesis Owing to the tilt of the superior surface of the first sacral vertebra, the last lumbar vertebra is constantly tending to slide downward and forward when the trunk is erect This is resisted by the lumbosacral ligaments, muscles and intervertebral disc and especially by the arrangement of the lumbosacral processes This antiluxation action of the articular process is entirely destroyed when the interarticular neural arch is separated in which case the lumbosacral stability is completely dependent upon the ligaments of the junction and the muscles which surround it This support is of course also destroyed when there is a fracture of the articular processes or a fracture of the pedicle or interarticular parts of the last lumbar neural arch These fractures are rare however and even in the presence of such fractures, spondylolisthesis may not take place Brailsford reports a case which illustrates this point a patient who had sustained a bilateral fracture of the pedicle of the fifth lumbar vertebra showed no anterior displacement of the vertebral body 8 years after injury Meyerding found in a large series of cases that separation of the neural arch of the fifth lumbar is visible in 70 per cent of roentgenograms showing definite spondylolisthesis while spina bifida occulta of the first sacral vertebra is present in about 35 per cent Willis found incomplete neural arch in 10 per cent of 100 cases of low back pain This is eight times the incidence found in laboratory specimens Meyerding says No doubt trauma is an etiological factor in spondylolisthesis but obesity



Fig 3 Case 1 Oblique view Diagram and roentgenogram showing more clearly the defect in the interarticular process of the fourth lumbar vertebra

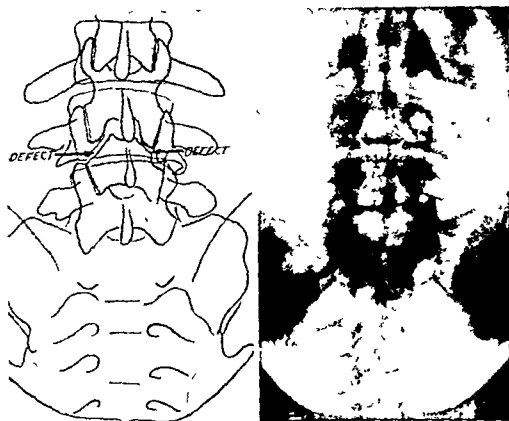


Fig 4 Case 1 Anteroposterior view Diagram and roentgenogram showing a bilateral defect of the interarticular processes, indicated by the arrows. Notice the mushroom-like and inverted saucer-like projections laterally on the under surface of the fourth, and the rounded upper surface of the fifth, lumbar vertebra. It seems that such a condition could develop only after years of activity in this joint. We believe that it could not have occurred in a few weeks or even a few months

ity, pregnancy, and occupational strain may gradually bring on the condition. The patient may not associate the injury with the complaint because it was sustained months or even years previous to the onset of symptoms. Sudden, severe injury may instantly disable the patient because of pain following subluxation." He further states, "A congenital defect could exist a lifetime without a patient's knowledge, even subluxation to a considerable degree could exist without symptoms. The chief complaint of patients with spondylolisthesis is backache, often accompanied by referred pain to the sacro-iliac joints, the hips, thighs, legs, and even the feet (85 per cent). The average duration of symptoms in the series of 207 cases was 8.76 years, yet in only a small percentage had the diagnosis been made.

"Clinical diagnosis was usually made by inspection and palpation of the back. One recognizes a depression above the sacrum with the sway back, muscle spasm, and prominent sacrum, a shortened torso and abdominal crease." Meyerding found arthritis complicating the condition in 20 per cent of the cases.

Neugebauer found that this imperfect ossification existed in 5 per cent of the specimens and, in the majority of those, the fifth lumbar vertebra was involved. He formulated the theory that spondylolisthesis is a static or traumatic deformity of the spine, favored by non-ossification of the lamina of the fifth lumbar vertebra. He states further "We recog-

nize nowadays three causes of the slipping (1) intra-articular spondyloschisis, unilateral or bilateral of the vertebral arch, the result of imperfect ossification or of fracture, (2) primary arthritis of the lumbosacral articulations (Strasser), (3) static (or pressure) deformity of the normal vertebra by a prolonged physiological strain (Lane)."

In a comparatively short time, three unusual cases of spondylolisthesis due to separation of the neural arch came to our attention. One affected the third lumbar, and the 2 others affected the fourth lumbar vertebra. All 3 cases involved injuries.

CASE 1 Patient was a male, aged 35 years, a well built, heavy man. While driving his own automobile, and sitting in the front seat, he stopped suddenly in front of a yellow light and the car coming from behind struck the rear of his machine. It should be remembered that he was sitting on a cushioned seat, that he got out of his car, and discussed the accident with the driver of the other car, and then got back into his car and drove home. Several days later, he consulted a physician, and later consulted a lawyer, because of pains in his back. On July 11, 1935, he was examined in one of the neighboring hospitals and on January 5, 1937, Dr. Joseph R. Post was called upon to make a roentgen study of the spine. A review of these films and the films made at the hospital, by Dr. Post and by us shows very clearly a spondylo-

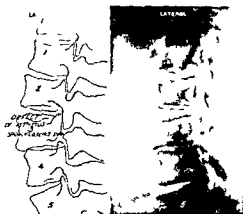


Fig 5 Case 2 Lateral view Diagram and roentgenogram showing the first second third fourth and fifth lumbar vertebrae with the spinal column including the third lumbar vertebra slipped forward approximately 1 centimeter in relation to the fourth. The arrow points to the defect in the interarticular process. Note especially that this defect involves the third lumbar, and not the fifth as is usual.

Isthesis with the fourth lumbar slipped forward in relation to the fifth approximately 1 centimeter both the lateral oblique and the anteroposterior views show a bilateral separation at the interarticular process. In addition to this the upper border of the fifth lumbar vertebra is rounded off as if it had been worn to this condition gradually during many years and furthermore the anteroposterior view shows the under surface of the fourth lumbar vertebra flattened and the lower edges project at least half a centimeter laterally beyond the upper border of the fifth. There can be no reasonable doubt in this case that the arch of the fourth lumbar vertebra had been

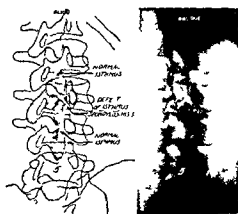


Fig 6 Case 2 Right oblique view Diagram and roentgenogram showing a podyololsthesis of the third lumbar vertebra. The arrow points to the interarticular defect.

incompletely formed and spondylosthesis had been present long before this accident. It is surely impossible for the changes observed on the adjacent surfaces of the fourth and fifth lumbar vertebrae to have taken place in 6 weeks time. In court however it was shown that this patient did heavy work preceding the accident and had been unable to work following the accident. Therefore the jury awarded this patient \$15,000 damages. The jury believed that this slight accident was the sole cause of his difficulty.

An experience of this kind emphasizes the importance of accurate interpretation in lumbar spine injuries. We can only give our testimony the jury must be the judge of the damages done. In all fairness as radiologists however we must keep in mind these spinal developmental defects and not attach too much importance to a slight injury. Unfortunately, we do not have the record of this patient since the trial but it seems inconceivable that very serious damage could be done to the spine of a person riding on a cushioned front seat of a car which was bumped in the rear by the oncoming car. The intensity of the impact of these two cars can be judged by the amount of damage to the cars. The cost of the repair of the two cars was \$13.00. It is well known that charges for repairs on automobiles under such conditions are not minimized.

CASE 2 Mrs H M aged 57 years was examined at the Women's Medical College Hospital on Octo-

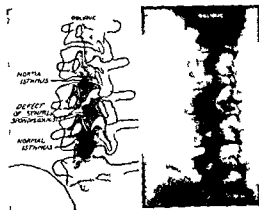


Fig 7 Case 2 Left oblique view Diagram and roentgenogram showing the defect of the interarticular process also on the left side.

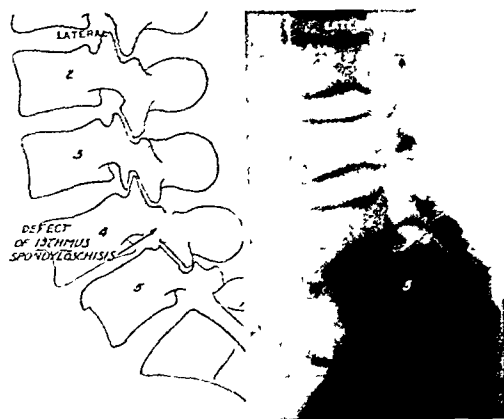


Fig 8 Case 3 Lateral view Diagram and roentgenogram showing a spondylolisthesis of the fourth lumbar vertebra. The arrow points to a defect in the interarticular process. This patient had no complaint referring to the back. Notice the saucer-like under surface of the fourth lumbar vertebra, and the rounded anterior edge of the fifth, indicating a very old condition.

ber 14, 1935. She gave no history of trauma to the back, but stated that she had had a weak back with occasional pain in the lower lumbar region since she was a girl. X-ray examination revealed an anterior displacement of the third lumbar vertebra on the fourth. Oblique views revealed the presence of a defect of the isthmus (interarticular portion of the neural arch). This was regarded as a spondylolisthesis. Re-examination at intervals since have not shown any change. Spondylolisthesis of the fifth lumbar vertebra occurs approximately 45 times as frequently as in the third. This patient has at no time had to interrupt her occupation on account of the spine.

CASE 3 Mr E S, white, male, aged 69 years, was referred to Women's College Hospital under the surgical service of Dr J S Rodman, on April 26, 1937, following an automobile accident the same day. X-ray examination at the time of admission revealed the presence of fractures of the right pubic bone. Patient gave a history of no previous injury to the back which had been sufficiently severe to make a permanent mental impression. Nevertheless at the time of examination, he was found to have an anterior displacement of the fourth lumbar on the fifth lumbar vertebra. There was sufficient calcification to warrant the conclusion that this was an old condition, and not the result of his recent accident. There was much calcification and deformity of the bodies of the fourth and fifth lumbar vertebrae. Bilateral defects were found at the time of the x-ray examination, involving the isthmus (interarticular space) producing an incomplete neural arch. This was felt to be an incidental finding not related to the injury for which he was admitted. Patient had no symptoms over the back. Patient has had an uneventful

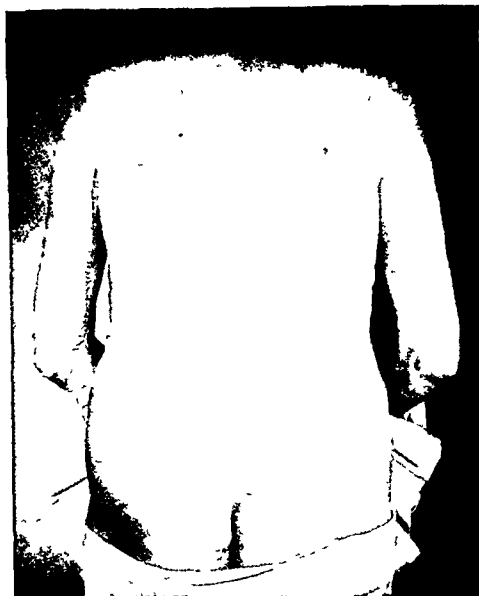


Fig 9 Case 3 Photograph showing the characteristic depression above the sacrum, which is usually associated with neighboring muscle spasm. Note also the prominence of the sacrum and the fifth lumbar vertebra.

recovery from the fracture of the pelvis, and has had no symptoms referable to the spinal deformity.

CASE 4 Mrs M G B, aged 77 years. Was referred by Dr Baldwin L Keyes on January 14, 1938. In September, 1937, while stepping from a chair, she caught her heel in the hem of her dress and fell. Since then, she has had pain in the lumbosacral region. X-ray examination made a few days later by Dr Joseph Roberts showed a very marked osteoarthritis involving all the joints of the spine, but particularly also a spondylolisthesis of the fourth lumbar vertebra. The fourth lumbar vertebra has slipped forward in relation to the fifth, approximately 0.5 centimeter. There was no evidence of fracture found by a careful study on this occasion by Dr. Roberts, nor in the subsequent examination by him, nor in the examination made by me on January 14, 1938. The films do show a marked osteoarthritis with particular destruction of the cartilage space between the articular processes of the fourth and fifth lumbar vertebrae. We think it is possible that this absorption of the cartilage between the articular processes is probably the important factor in this particular case of spondylolisthesis. The neural arch is not fractured nor is it incomplete. This patient had other senile changes, for example the abdominal aorta is markedly calcified. There is also a slight total lateral scoliosis which we think is due to the irregular absorption of the cartilage in the joint spaces. There was also found a few days after the fall, a partial compression of the seventh dorsal



Fig 10. Case 4. A Lateral view. B Oblique view. A spondylolisthesis of the fourth lumbar vertebra found after an injury but probably due to an osteoarthritis caused by degenerations associated with age and osteoarthritis. Note the calcification in the aorta in A and B. Note the condensation in the upper and lower adjacent surfaces of the third, fourth and fifth lumbar vertebrae. In B the oblique view note the bridge process across the anterior surface of the intervertebral disc and note the contraction between the articular processes.

and of the first lumbar vertebrae with bone changes consisting of sclerosis and mushroom like projection forward from the upper anterior surface which could not possibly have been formed in a few days time. These bone changes must have taken place during months or years preceding the injury and must have been present at the time even of this slight injury.

The first of these 3 patients was involved in a relatively mild accident which would ordinarily be unnoticed by a driver. The fact that the patient could get out, walk about the car and discuss the damages with the other driver and waited several days to consult a physician and the fact that the damages to the two cars combined amounted to \$33.00 would seem to indicate that the accident was not a very severe one. Especially is this to be considered because of the fact that the patient was riding in a cushioned seat. In spite of this the jury was sufficiently impressed by the mere presence of this spondylolisthesis which was called a fracture to lead the jurors to render a verdict of \$15,000. The second case gave no history of any injury and suffered only occasionally from pains in the back. She at no time had to

discontinue her work nor had any other serious complaint. This shows that this condition can be present over a long period of time without being recognized, yet if such patient were to receive an injury to the back, there would be great danger of assigning all symptoms and damages to the recent accident. The third case had an accident to the pelvis and had definite evidence of fractures of the pelvis yet the patient did not complain of any symptoms in the back previously nor at the time of the examination. The spondylolisthesis was an incidental finding. Bone changes in both the fourth and fifth lumbar vertebrae as well as the spondylolisthesis were present immediately after the accident. These bone changes could not have taken place immediately after the accident.

SUMMARY AND CONCLUSIONS

We have reviewed some of the literature bearing upon the general subject of spondylolisthesis and spondyloschisis in relation to injuries involving the lumbar spine. Authorities in general recognize that a defect of the in-

terarticular process is the most common condition associated with spondylolisthesis. Spondylolisthesis is usually secondary to traumatism, but may follow repeated slight trauma instead of a single severe injury. Great care is necessary in evaluating the effects of any slight or recent injury in relation to such defects. In any serious injury to the lumbar spine or lumbosacral region, and especially if associated with marked symptoms in any slight injury, the spine should be examined by the roentgenologist at least by means of anteroposterior, lateral, and two oblique views of the spine.

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AN EXACT METHOD OF DETERMINING OVULATION AND PREGNANCY

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IN treating one of my patients for primary amenorrhea I used the organo short wave method and so far have succeeded in causing a menstrual flow which has appeared up to the present time 10 times, with a cycle of 28 days. During this series of treatments I have made the following observations.

The day before the second menstruation occurred I found when making an endocrine electrodiagram, that the system was perfectly balanced, but that all the figures oscillated in a remarkable manner around 180. At first I could find no explanation for this. Eight days after the menstrual period the endocrine system was also balanced but at this time the figures had moved to the level of 150. Therefore I endeavored to discover in the normal woman the relationship existing between the reduction figures taken daily of the oxyhemoglobin test before and after menstruation.

It appeared that during the menstrual cycle, these figures showed typical oscillations.

From the Institute for Short Wave Therapy Amsterdam

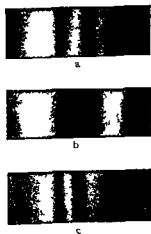


Fig 1 Spectrum views a Oxyhemoglobin b reduction c methemoglobin

tions, thus, in a simple manner and with accuracy, the increasing and the decreasing of the basal metabolism can be used as an index of the hormone levels before, during and after menstruation and during ovulation. The graph which I made with these figures I called a "cyclogram". The cyclogram will be described in detail, also its bearing on the question of conception and abstinence, and especially as regards the determination of pregnancy. The cyclogram shows by the reduction figures how exactly the position of the hormone level is indicated, that is the content of the blood in activators and regulators of the basal metabolism.

The basis of the method is as follows.

One of the interdigital webs preferably that between the thumb and index finger is clamped off by means of the fenestrated pelotte of the cycloscope, in this way a temporary interruption of the circulation is induced in an area measuring about 6 millimeters. Spectroscopic examination of this section of the tissues in good illumination shows in the yellow and green portions of the spectrum two sharply defined dark absorption bands—those of oxyhemoglobin (HbO_2)—between which is found a sharply defined light yellow band (Fig 1a). After a short time the dark bands become indefinite, fade away and finally completely disappear (Fig 1b). In the place of these bands, separated by an interval of yellow, there appears a broad gray homogeneous band. At this point reduction of the tissue which is being examined has combined with the oxygen of the oxyhemoglobin (tissue respiration). If conclusions of importance are in question it is advisable to estimate the reduction time in two or three successive observations and to take the average. The slight variations are due to lack of complete accuracy in the examining eye. With some little practice and experience this factor can

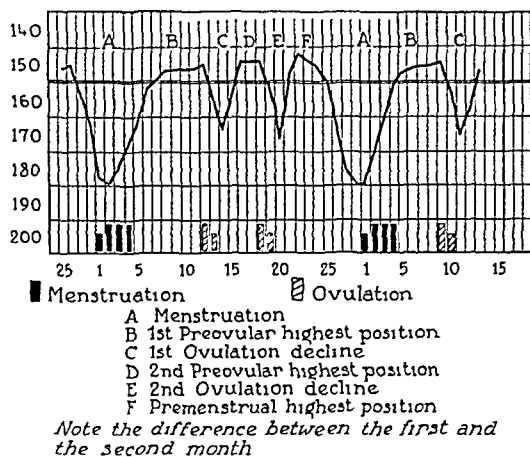


Fig 2 Normal cyclogram

be eliminated, and the exact time estimated to a second. It is also advisable for the beginner to conduct the examination in a darkened room or in artificial light, by which means a sharper and more definite view of the process in question is obtained.

After 5 to 7 seconds, two new bands will be seen, lying somewhat more closely one to another, i.e., separated by a narrower yellow green space. (The whole picture is less distinct, and in addition lies somewhat more to the left of the spectrum than the oxyhemoglobin bands.) These are the absorption bands of methemoglobin (HbO) (Fig. 1c). The beginner will find it simpler in the estimation of the reduction time of oxyhemoglobin, to await the appearance of the methemoglobin bands, and then deduct about 5 seconds from the time established as necessary for this. If the conditions are further observed it will be seen that the methemoglobin bands again disappear with a rapidity which varies in different persons (10 to 40 seconds). The same sequence of events is now repeated several times, and at a quicker rate (tissue respiration). It is conceivable that the measurement of the time taken by this coming and going of the methemoglobin bands might prove to be of importance in the differential diagnosis between various diseases.

When, after the reduction time has been measured, the constriction is released—so

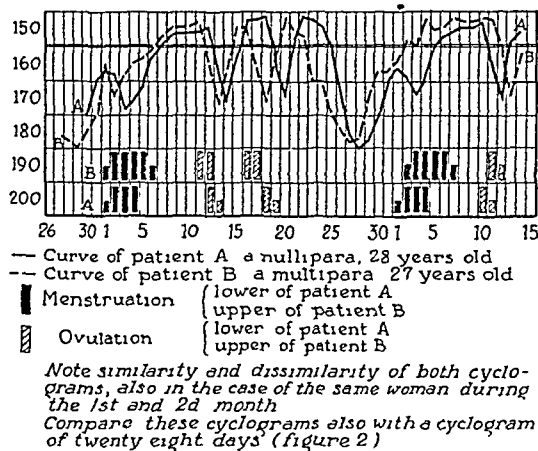


Fig 3 Cyclogram of 2 women with cycle of 31 days each

that the circulation is once more restored and there is a new supply of blood containing oxyhemoglobin—there is a sudden reappearance of the oxyhemoglobin bands with the broad yellow band in between. It is advisable when a number of successive counts are made not to clamp the same place each time. A sketch of the two hands should be made and the sites at which the clamp has been applied marked with small crosses.

Vierort (1876) and Henocque, and later Hoppe-Seyler, Guillaume, Erich Meyer, and Reinhold (1926), Lucas, Zondek, Ucko, and Koch were the first to try to investigate in animals and in men the reduction time of oxyhemoglobin for the differential diagnosis in various diseases. The influence of poisons, especially of anesthetics and narcotics on the basal metabolism rate and the blood of animal organism was also determined by this method (E Meyer and Reinhold). Subsequently Dausset in 1936 recommended this method of analyzing the endocrine system. The importance of this method is greatly increased when it is used to determine the cycle curve, the ovulation time, and pregnancy.

With a simple instrument, the cycloscope (Fig 8), the reduction time is determined. In the case of healthy, normal people, with a balanced endocrine system, this is about 150 seconds. With men and women in the climacteric, the reduction figures, taken daily, are

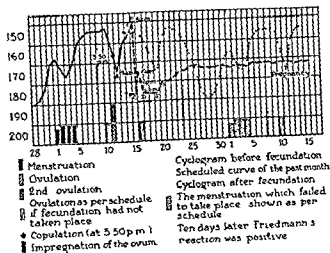


Fig. 4. Cyclogram before and after fecundation of a woman with a cycle of 31 days

constantly around about 145 seconds. In the sexually mature woman these figures are apt to oscillate.

If the reduction figure of a woman aged 30 is ascertained every day for a month, that is in a woman in the prime of sexual life, with a cycle duration of 28 days (Fig. 2), such a cyclogram shows 3 declines of which the decline of menstruation (Fig. 2 A) is the most pronounced. The 2 other declines (Fig. 2 C and E) are shorter in duration and deviate slightly. In abdominal operations after the decline of ovulation had been observed with the cycloscope, a recently burst graafian follicle was always seen.

Further it has been learned that in a series of 20 sexually mature women between the ages of 25 and 40, who were examined, all ovulated twice a month (Figs. 2, 3, 4). Most nulliparae of which the youngest examined by me was 16 and the oldest 23 years old ovulated three times (Fig. 7). The pre-ovular increase of the hormone level is a complicated process which is associated with the increasing production of folliculin gonadotropic and other hormones, as a preparation for ovulation. In the cyclogram the decline of ovulation is the manifestation of a similar complicated process, which consists in an abrupt interruption of the folliculin and anterior

pituitary hormone formation, and the production of the luteinization hormone. When performing abdominal operations on 2 patients I had the opportunity of ascertaining that on one occasion the left and on the other the right ovary was ovulating. One of the patients, a woman 29 years old, was operated upon for retroflexion of the uterus, the other, a girl of 17 years, for chronic appendicitis. In both cases the operation was performed after the determination of the second ovulation.

In a patient with retroflexion of the uterus, who appeared to ovulate twice a month a freshly burst graafian follicle was found in the left ovary, and in the right a fresh corpus luteum. In the case of a patient operated upon for appendicitis who had three ovulations per cycle (Fig. 7), a freshly burst graafian follicle was found in the right ovary and in the left a fresh corpus luteum and a follicle in the course of development. Thus the proof was furnished that the declines shown in the cyclogram—which are mostly visible on the ninth, tenth, eleventh, or twelfth day and on the seven, tenth or eighteenth days of the cycle—depend on two and three ovulations respectively during one cycle. This study further proves that ova develop and ripen according to certain laws and that graafian follicles burst independently, although between ovulation and menstruation a certain relation of time exists.

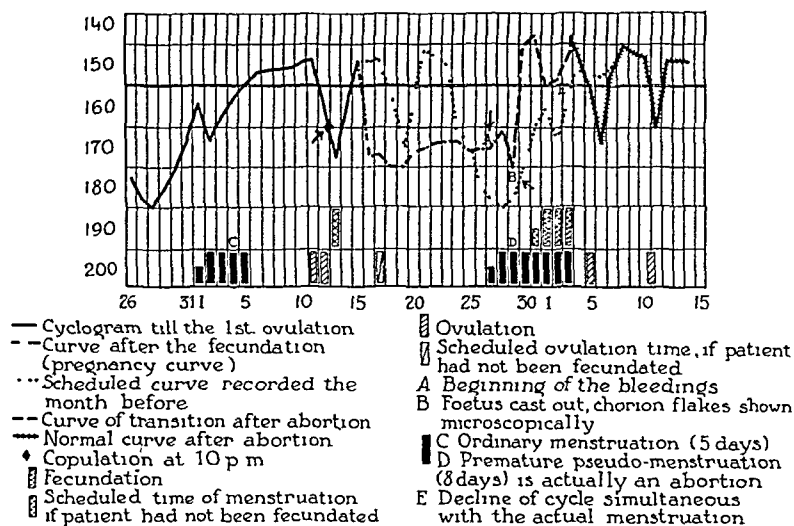


Fig 5 Cyclogram of young pregnancy and abortion—cycle 31 days

So far it has not been possible to ascertain accurately by any method when a woman ovulates. Halban and Koehler have stated that a woman ovulates between the eighth and eighteenth day before the menstruation, Shaw named the thirteenth to the seventeenth day, Schroeder the fourteenth to the sixteenth day, Ogino the thirteenth to the seventeenth day, and Knaus states the fifteenth day before the menstruation. There has always been mention of one ovum only. By the method of examination described, it has been proved that a woman releases at least two ova during one cycle. This is quite obvious, since a woman has two ovaries. Also the occurrence of two-ova twins, superfetation, and superfecundation prove that during a cycle more than one ovum is released. Yet, until now the theory has been maintained that there is only one ovum per cycle. The use of the cycloscope has reduced to an exact science the accurate determination of the day on which a woman ovulates.

In Figure 2 the following phases are shown in the cyclogram: The decline of menstruation, *A*; the first pre-ovular highest position, *B*; the first ovulation decline, *C*; the second pre-ovular highest position, *D*; the second ovulation decline, *E*; and the premenstrual highest position, *F*. The highest and the

lowest figures and also the duration of the phases vary in different women, and also in the same woman during succeeding months. In women with a cycle of 26 to 28 days and those with a cycle of 30 to 31 days, there is a difference in the time and the course of the menstruation decline (compare the similarities and dissimilarities in Figures 2 and 3). With young women—and sometimes also with older women—we often find all the figures raised. It happens, especially in the case of young girls who ovulate three times (Fig 7) that the decline and rise of the ovulation take place in one day only and that, in between, there is hardly any intermission. Only in quite exceptional cases is the time of ovulation also protracted.

The most likely time for a woman to conceive is during the days of the declining ovulation curve. Even the day after the very lowest point, conception is doubtful, and a day later it is practically impossible, since we know that the ovum can be fertilized for 2 days only. The problem of determining the time of conception has thereby been solved in quite a simple manner.

The problem of abstinence is entirely different for the various research workers (Knaus, Pryll, Nuernberger) do not agree as to the duration of the life of the spermatozoa in the

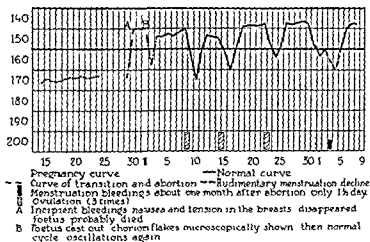


Fig. 6 Cyclogram of pregnancy and abortion

female genital tract (2 to 15 days). This problem cannot be dealt with here in detail. It can, however, be stated that a woman is sterile after her last ovulation until the next menstruation. During the menstrual period, and about 3 to 4 days after a woman is most probably sterile if, according to Knaus, the spermatozoa retain the power of fertilizing for only about 2 days, during the remaining time there is a chance of conception. From the foregoing it follows that the time of absolute sterility is longer in the woman with a cycle of 31 days than in the woman with a cycle of 26 to 28 days, in the case of young girls having three ovulation periods the time is shorter.

Mikulicz, Radecki and other research workers of recent years, state that the spermatozoa travel 2 to 3 millimeters per minute. In 1 hour this results in a total distance of 12 to 18 centimeters (Stoeckel). According to this calculation it is possible for the spermatozoa to have reached the ampullary section of the fallopian tube within 90 minutes and there impregnate the ovum. It is of equal if not of greater importance that pregnancy stops menstruation and ovulation, and that along with these the cycle oscillations of a woman stop also. Inversely it has been learned, by examining many pregnant women that in this simple and easy manner we can diagnose pregnancy, since the daily reduction

figures remain always constant. In the case of an early pregnancy in a healthy woman with a balanced endocrine system, we find daily constant reduction figures of 155 (youthful gravid women) to 165. From the second until the seventh or eighth month this figure remains constantly around 160, rising toward the end of the pregnancy to 155. Shortly before delivery these figures drop to around 165, often showing oscillations immediately before the birth of the child. It may be assumed that the decline, and the oscillations immediately before the birth of a child, are connected with the changed hormone production of the hypophysis, the placenta, the decidua, and the corpus luteum verum. By this simple method the differential diagnosis between fibromyoma, *grossesse nerveuse*, and pregnancy, can easily be made. Also the diagnosis of extra uterine pregnancy and a fleshy mole becomes simpler in this manner. Slight differences of about 5 second a day, the reduction number being then usually a little higher in the evening than in the morning, are not of any importance in judging the curve. Yet it is advisable to ascertain the daily reduction figures preferably at the same hour, and if great accuracy is demanded, to perform the examination in a dark room, or by artificial light.

The questions which remained to be answered were how quickly by this method can

we ascertain the change in the cycle due to the pregnancy? Is this method quicker than the Aschheim-Zondek test? Even though the two methods are equally quick, this simple examination, which can readily be mastered by any doctor, deserves preference. It has been proved however that our method is faster (Figs 4 and 5).

The following observations made with a young woman who already had two healthy children and desired a third, clearly prove our point. I assisted her at her last confinement, which was normal.

The husband and wife were very intelligent, he was 30, and she was 25 years old. She had a perfectly normal nervous system, was healthy and strong, and free from any autosuggestion. For these reasons her subjective complaints and remarks deserved our undivided attention for the scientific records. After the birth of the last child, which was nearly 1 year old, she had always used an occlusive pessary by which for the time being pregnancy had been prevented. For a month the cycle curve had been recorded. The following month the first ovulation was awaited (Fig. 4), and at about 10 a. m., on the eleventh cycle day the reduction number, which the day before was 143 had dropped to 152, so that ovulation was determined, and we could assume that the ovum had become free about 12 to 18 hours previously. In the afternoon at about 3 30 p. m. coitus took place for the first time during the entire month without the use of the pessary, so that with fairly great certainty the conclusion could be drawn that fertilization, if any, could have taken place only by this intercourse.

Later the patient became pregnant. If we assume (like Mikulicz, Radecki, Stoeckel) that the spermatozoa can have arrived at the ampullary end of the fallopian tube within 2 hours, then the fecundation took place on the same cycle day, most likely before 6 p. m. The curve continued in a normal way during the eleventh, twelfth, thirteenth, and a part of the fourteenth cycle day. This probably covers the time before the ovum had become embedded, in any case the influence of the fertilized ovum had not yet become strong enough to cause hormonal changes in the maternal organism. On the thirteenth cycle day the reduction figure was taken at 10 a. m. and also at 8 p. m. The difference between these two figures was insignificant. On the fourteenth cycle day, at 10 a. m., the reduction figure was still 145. But at 8 p. m. something out of the ordinary happened. The figure rose for the first time during the entire cycle to 140. On the fifteenth cycle day, at about 10 a. m., the curve dropped to 165, and in the evening even to 175. A glance at Figure 4 convinces us how entirely different this course was as compared with the previous month. While this

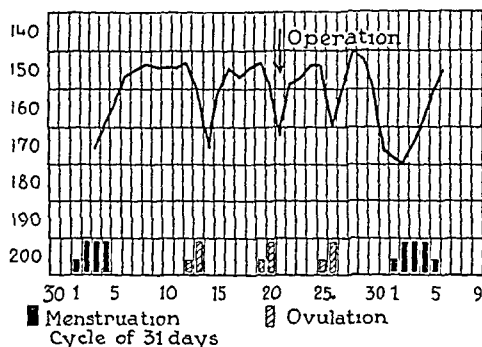


Fig. 7 Cyclogram of a girl 17 years old operated upon for chronic appendicitis during the second ovulation. In the right ovary a freshly burst graafian follicle, in the left a fresh corpus luteum and a follicle in the course of development.

curve had risen to its highest point of 140 during the previous evening, it dropped the next evening to the very lowest point of 175, which figure is seen only during or before the menstruation, but never during the intermenstrual time. The next morning the reduction figure was 165, in the evening it was again 175, on the seventeenth cycle day it was for the first time in the morning and in the evening 175. During the 3 following days the figure remained stationary at 175, then going up slowly, first between 165 and 170, remaining finally constant between 160 and 165.

The maternal organism, therefore, first needs some time to adjust itself, during which it adapts itself to the hormonal influences which are changed by the pregnancy. Then the hormonal balance becomes constant due to complementary and antagonistic influences of the hypophysis, the ovaries, the corpus luteum, the chorion, and the decidua.

This vital reaction would indicate that the patient became pregnant on the evening of the third day after fertilization (Fig. 4, B) by the unusually high position of the figure, on the fourth day the presence of pregnancy is still more assured by the unusual decline, C; one day later, D, the pregnancy was diagnosed almost with certainty. If we are very cautious we record the curve two or three days longer. If this line remains constantly low D, E, F, then there is no doubt that the diagnosis of a beginning pregnancy is correct even at this early date. With a woman having a cycle of 31 days, if she has been fertilized during the first ovulation, we can consequently determine the diagnosis with absolute certainty on the

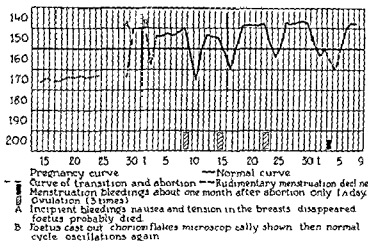


Fig. 6 Cyclogram of pregnancy and abortion.

female genital tract (2 to 15 days). This problem cannot be dealt with here in detail. It can, however, be stated that a woman is sterile after her last ovulation until the next menstruation. During the menstrual period, and about 3 to 4 days after a woman is most probably sterile if, according to Knäus, the spermatozoa retain the power of fertilizing for only about 2 days during the remaining time there is a chance of conception. From the foregoing it follows that the time of absolute sterility is longer in the woman with a cycle of 31 days than in the woman with a cycle of 26 to 28 days, in the case of young girls having three ovulation periods the time is shorter.

Mikulicz, Radecki, and other research workers of recent years, state that the spermatozoa travel 2 to 3 millimeters per minute. In 1 hour this results in a total distance of 12 to 18 centimeters (Stoeckel). According to this calculation it is possible for the spermatozoa to have reached the ampullary section of the fallopian tube within 90 minutes and there impregnate the ovum. It is of equal, if not of greater importance that pregnancy stops menstruation and ovulation, and that along with these the cycle oscillations of a woman stop also. Inversely it has been learned by examining many pregnant women that in this simple and easy manner we can diagnose pregnancy, since the daily reduction

figures remain always constant. In the case of an early pregnancy in a healthy woman with a balanced endocrine system, we find daily constant reduction figures of 155 (young full gravid women) to 165. From the second until the seventh or eighth month this figure remains constantly around 160, rising toward the end of the pregnancy to 155. Shortly before delivery these figures drop to around 165 often showing oscillations immediately before the birth of the child. It may be assumed that the decline, and the oscillations immediately before the birth of a child, are connected with the changed hormone production of the hypophysis, the placenta, the decidua, and the corpus luteum verum. By this simple method the differential diagnosis between fibromyoma, *grossesse nerveuse*, and pregnancy, can easily be made. Also the diagnosis of extra uterine pregnancy and a fleshy mole becomes simpler in this manner. Slight differences of about 5 seconds a day the reduction number being then usually a little higher in the evening than in the morning are not of any importance in judging the curve. Yet it is advisable to ascertain the daily reduction figures preferably at the same hour, and if great accuracy is demanded to perform the examination in a dark room, or by artificial light.

The questions which remained to be answered were how quickly by this method can

ADVANTAGES OF THE METHOD

This method of determining the presence of pregnancy has the following advantages:

1 It is extremely simple, every doctor can make the diagnosis with the aid of the cycloscope

2 It is absolute, because it is not based on biological animal experiments, a certain percentage of which will turn out positive and another negative, but upon the endogenous hormonal changes in the maternal organism. Such changes are brought about by the hormone reactions of the hypophysis, the ovaries, the corpus luteum, the chorion, and the decidua, consequently they are vital changes due to fertilization

3 By this method the diagnosis of pregnancy can be made more quickly than by any other. When by such a method we can declare that pregnancy exists there is no further need to use the Aschheim-Zondek or Friedmann reaction tests, because even before menstruation fails to take place, the spectroscopic diagnosis can be made. It would be interesting to diagnose pregnancy first with the cycloscope and then to see whether at such an early date it would be possible to obtain an animal biological reaction

In young women who are pregnant we often find higher reduction figures, namely, 150 to 160. Also during illness in a pregnant woman the initial time is moved up higher, for instance, in most forms of anemia, asthma, bronchitis, Basedow's disease, and tuberculosis. Inversely, for instance in diabetes, we have found lower reduction figures, especially in those patients in whom the illness had not yet been treated with insulin, or diet. Here also the daily constant figures confirm the diagnosis of pregnancy. If there is any doubt in the case of pregnant women suffering from some illness, then the time of observation can be extended a few days.

A second interesting pregnancy has been recorded in the curve shown in Figure 5

In this case we were able to make the record only during the daytime, and for this reason the highest levels, and possibly also the lowest levels, as recorded on Figure 4, escaped notice. The patient was fertilized on the twelfth cycle day. On the nineteenth cycle day pregnancy could be determined

with certainty. The patient had a fall on the twenty-seventh day, that is, on the fifth day before menstruation was expected, as a result of this fall bleeding from the genitals occurred. The course of the pregnancy and of the subsequent abortion is shown in the cyclogram. Young chorion flakes and decidua were detected in the discharge. Women often tell us that when menstruation is premature, it is more profuse and lasts longer than usual. Such a premature menstrual period is often caused by an interrupted early pregnancy, which until then had escaped detection.

Figure 6 shows how the constant pregnancy cyclogram was changed after abortion, that is, after the interruption of the pregnancy. This cyclogram was made in the case of a woman 23 years old, pregnant about a month, who miscarried after a long motor ride.

The instrument we use to determine the reduction figures of the cyclogram and with which we make the diagnosis of pregnancy is the cycloscope¹ or spectroreductometer. The cycloscope consists of a spectroscope, a lens, two rubber or metal cushions which press on the interdigital fold, stopping the circulation, each with an opening of 6 millimeters, a pair of forceps, and a light of about 150 candle power (an ordinary show-window lamp with a mercury mirror). After the oxyhemoglobin stripes have been sharply put in focus, the light is switched off, usually for about 120 seconds, and then it is switched on again. In this manner the eye is more accurately adjusted for the determination of the reduction time. For our clinic apparatus was built by which, synchronously with the running of a clock, the reduction time was photographed on a narrow film. The films were then hung on a frame, the reduction time determined and copied on to a graph. This procedure also makes it possible to project the picture on a screen.

SUMMARY

This paper describes a spectroscopic method of diagnosing pregnancy which consists in ascertaining daily the reduction figures of oxyhemoglobin by means of an instrument easy to use—the cycloscope—with which it is possible.

1 To determine when a woman ovulates, which is of considerable importance in solving many problems of conception.

¹Obtainable from Andersen & Polak, P. C. Hoofstraat 40, Amsterdam

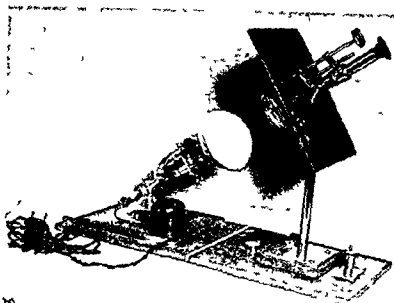


Fig 8 Cjloscope used by author

eighteenth or nineteenth cycle day. This is then 7 or 8 days after the fecundation and about 12 days before the next menstruation. With a woman having a cycle of 28 days, who has been fertilized at the first ovulation, we can make a diagnosis 9 to 10 days before the expected menstruation. If the fecundation takes place at the second ovulation, then 6 or 7 days later the diagnosis is certain. In any case the diagnosis of pregnancy can be made before the time the next menstruation would normally occur. Only in the case of men and women in the postclimacteric age is there a similar constant reduction in the figures, which then, however, are around 145. The constant figures of 165-170 obtained for 4 to 5 consecutive days indicate with certainty the diagnosis of pregnancy whether during the intermenstrual period or during the menstrual period with bleeding absent. The diagnosis is absolute because a vital change in the cycle has occurred which otherwise does not occur in the sexually mature woman.

It is important to mention some subjective symptoms present in the patient and usually disregarded by women or for which as a rule, some other explanation is given for inter alia the diagnosis of pregnancy at so early a

stage has never before been described. On the twelfth and thirteenth cycle day (Fig 4, A and B) the patient noticed a greater secretion of mucus, at C, frequent micturition, an intermittent secretion of mucus pain and tension in the breast, at D the same symptoms and in addition a feeling of tension and swelling of the external genitals, at E, nausea, borborygmus, nervousness, fatigue, palpitations of the heart. On the twentieth and twenty-first days, F the nausea fatigue and borborygmus increased. Also during this time the sensitiveness and the swelling of the breasts persisted. Then the subjective phenomena decreased gradually. Figure 4 shows the further course of events. The reduction figures taken daily remained constant, around 162 and 165. While menstruation had before been normal it now failed to take place at the expected time, as shown in the cyclogram. When 10 days had elapsed after the normal time for the menses the Friedmann test was made as a control and it was positive for pregnancy. At the time of writing this paper patient had not menstruated for 3 months, and bimanual examination proved she had been pregnant for more than 3 months. The reduction figures now remain constant—around 160.

RECTAL ULCERATION FOLLOWING IRRADIATION TREATMENT OF CARCINOMA OF THE CERVIX UTERI

Pseudo-Carcinoma of the Rectum

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THAT rectal complications may occur after radiation treatment of carcinoma of the cervix is a phenomenon well recognized by all who have a large experience of this branch of radiotherapy, but the nature and clinical picture produced by these lesions is not generally known or recognized. The author has had the advantage of studying the available material of a large radium center, treating between 150 and 200 new cases of carcinoma of the cervix yearly, and a sufficient number of these complications have been encountered to permit analysis. The peculiar nature of the most characteristic lesion—the so called “false carcinoma” (Hartmann)—stimulated a search of the relevant literature, with disappointing results. Beyond casual mention of the possibility of such complications, there are few publications giving any precise or informative account of a lesion that can assume a variety of forms, and form a diagnostic puzzle as fascinating as any to be found in clinical medicine.

It is undeniable that the nature of these lesions in the rectum is not generally recognized, particularly by gynecologists with a limited experience of radiotherapy. In my own experience, in the past year, one patient was just saved from a perineal excision of the rectum on a mistaken diagnosis of carcinoma, while 2 others were referred for radiation therapy diagnosed as carcinoma of the rectum. Fortunately, this was not carried out owing to the fact that the real condition was appreciated in time. Yet there is nothing particularly difficult about the diagnosis of post-irradiation

ulceration of the rectum, once the existence of the condition is known and if the history of previous irradiation is borne in mind. Many cases escape recognition altogether because the symptoms are so mild, and the natural course of the untreated disease is toward a spontaneous cure in most cases. The tragic results that may follow non-recognition will be only too readily appreciated.

LITERATURE

In the scanty literature available, there seems to be general agreement that the lesions found are, in the main, either acute or chronic, and that the characteristic lesions are chronic. The most informative paper is by P Tison and later I follow his classification of these lesions, as I do not think it can well be bettered. He divides the chronic reactions into intrinsic and extrinsic types. Colwell and Russ make but brief reference to rectal complications, with no attempt to any accurate or detailed clinical description. Rolleston, in his review of the harmful effects of radiation, merely mentions the fact that ulceration may be a sequel to radium treatment of carcinoma of the cervix. In the *Report of the Marie Curie Hospital for 1934*, the occurrence of rectal lesions in as many as 12 per cent of the cases treated in 1929 is described, but this high incidence was reduced to about 3 per cent in 1932. Laborde, in her book *La Curiothérapie des Cancers*, describes the occurrence of proctitis followed by stenosis, and she remarks on the peculiar sensitivity of the rectal mucosa. Again, with Cottenot in 1934, she describes an acute and a chronic form of rectal lesion. B Ottow describes rectal ulcers following radiation, and comments on their resemblance to syphilitic ulcers. The American authors, Buie

Research fellow at the Christie Hospital and Holt Radium Institute, Manchester. Honorary assistant gynecologist to Salford Royal Hospital.

Hunterian lecture delivered at the Royal College of Surgeons of England, London, February 4, 1938.

2 To diagnose pregnancy quickly and absolutely accurately. The method makes the diagnosis possible for any doctor without the use of a laboratory or animal biological reaction

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further cases have been seen since January, 1937, but it is too early yet to submit them to detailed analysis

These lesions occurred on an average about 6 months after treatment, but I have known a case develop within 1 month, and, on the other hand, another which did not appear until 6 years after treatment, the majority occur within a year, or, at the outside, 2 years, of treatment. The incidence of the complications is about 5 per cent of treated cases at most clinics, although one would not realize this from their published reports. Among the cases of carcinoma of the cervix treated at the Christie Hospital and Holt Radium Institute in 1933 and 1934, there were 14 cases of late rectal reaction, being a percentage incidence of 4.5 of all treated cases. In a personal communication, Miss Hurdon reported a similar incidence in cases treated at the Marie Curie Hospital, London, and while visiting the Radiumhemmet, Stockholm, I gathered the impression that this was approximately the incidence in Dr Heyman's cases, too.

There are two quite definite types of chronic late radium reaction in the rectum, appositely named by Tison (loc cit) as intrinsic and extrinsic. In the first group, the lesion is strictly limited to the actual rectum, whereas in the second group it appears pre-eminently as a peri-rectal lesion. Both types resemble carcinoma of the rectum in their symptoms and physical signs, the intrinsic variety simulating an operable growth, and the extrinsic variety an inoperable one. I have coined the term "pseudocarcinoma" for these lesions, as it can be equally applied to either variety, and is, I think, more apt than Hartmann's *faux carcinoma*. I fully appreciate that to the etymological purist such a term is unforgivable, but it is at least arresting, and it does stress the most important single feature of these cases, namely their close clinical resemblance to carcinoma of the rectum—and this is my justification for such a solecism.

Tables I and II are a summary of 26 chronic reactions. In my experience the lesions fall about equally into the two groups. All these 26 cases have been under my personal care, the 12 other cases described are not analyzed, either because they occurred before 1934, and

so were not under my care from the beginning, or have occurred since 1935, and it is too soon to complete the analysis. The summary shows that the average time of onset was between 6 and 8 months of treatment, and that, on the whole, relatively large amounts of radiation were employed. In all except 4 cases, x-rays were used as well as radium. In some cases, the radium therapy followed the x-ray course, while in others it both preceded and followed it.

I will now discuss the two groups individually as regards their clinical picture, morphology, and prognosis, and later I will discuss them together with reference to their etiology, pathology, and treatment.

A INTRINSIC REACTIONS

The first warning that anything abnormal is occurring is usually in the form of small and repeated rectal hemorrhages accompanied by pelvic discomfort after defecation. The symptoms are seldom severe in the early stages, but later pain may develop, and possibly stenosis of the rectum. There is generally no constitutional upset in this group.

On digital examination, an intrinsic lesion is felt as a slight irregularity and thickening of the mucosa, usually at the level of the cervix, but in some cases—when associated with an etiological factor to be discussed further on—up to 2 inches higher or lower. Sigmoidoscopic examination shows the mucosa to be glazed, edematous, and bleeding on contact. This premonitory stage is soon followed, in the course of 3 or 4 weeks, by the development of the typical lesion. The glazed mucosa becomes covered with a thin, grayish-white exudate, and a proliferative granulation tissue reaction in the submucosa causes a gradual thickening at the periphery of the developing ulcer. Finally, the mucosa ulcerates completely, and becomes replaced by a characteristic diphtheritic slough. The size of the fully formed ulcer is anything from a two-shilling to a five-shilling piece, and it is surrounded by an area of granular proctitis from which bleeding occurs on the slightest touch. The grayish slough in the base of the ulcer stands out in marked contrast to the acute phenomena around, and there is a definite resemblance to syphilitic ulceration. The whole lesion is quite mobile

and Malmgren name the complication "fistulous proctitis" and describe it as "a justifiable lesion following irradiation." Gabriel, in his monograph *The Principles and Practice of Rectal Surgery* devotes but one paragraph to the description of chronic inflammatory proctitis and stricture formation following radium treatment of cervical cancer. The occurrence of these lesions appears elsewhere to call for but little special comment, and nowhere is the pathology detailed. It is not surprising that misdiagnosis occurs so frequently.

PERSONAL CASES

The lesions with which I am concerned chiefly are the late rectal reactions. Acute proctitis occurs undoubtedly in an appreciable percentage of cases manifesting itself by the occurrence of tenesmus, frequency of defecation, and occasional rectal hemorrhage. Usually these symptoms are slight and cause only trifling inconvenience in the latter part of treatment, or in the week or two immediately following. Sigmoidoscopic examination in such cases shows a diffuse hyperemia of the rectal mucosa from about 2 inches above the anus to the pelvicrectal juncture plus the presence of fibrinous flakes. This hyperemia is most obvious on the anterior rectal wall and the passage of the instrument may provoke a few spots of bleeding. Alternatively the reaction may be manifested by the presence of a diffuse mucosal edema at the same site the mucosa being bathed in watery mucus. In the more severe cases granular proctitis may be present on the anterior rectal wall at the level of the cervix uteri. In most of these cases the prognosis is excellent. It is held by some that these acute phenomena are inevitably the precursors of the more serious chronic lesions, but I have seen only one such case. The majority of cases showing acute phenomena have cleared up completely shortly after the termination of treatment. One most unusual case occurred—a stage III carcinoma of the cervix treated with x rays only 4,000 roentgen units being delivered to the cervix in the course of 4 weeks. During the last week of treatment the patient developed severe intestinal symptoms due to enteritis and proctitis and she died of toxemia within 3 weeks. Sigmoid

oscopy had shown the presence of acute proctitis with some mucosal desquamation at the level of the cervix on the anterior rectal wall. At autopsy, there was a patchy ulceration of the small intestine and the rectum and microscopy showed mucosal necrosis in these areas. In this case the rectal lesion appeared to be but part of a widespread acute enteritis the affected loops of gut being those that lay within the irradiated area in the hypogastrium and pelvis. It is impossible to deny that the rectal lesion was a post irradiation effect, but I have not seen any thing similar in other cases.

In order to try to find any evidence of preliminary changes which might later be associated with the development of a rectal reaction routine proctoscopy has been carried out on all cases at the time of first and last treatments for 2 years now, without any definite evidence being gained so far. In a large percentage of cases there is a quite appreciable reaction to be seen at the end of treatment in the form of mucosal edema and sometimes a few fibrinous flakes, but this appears to be a normal phenomenon, and subsides in the next few weeks. Proctoscopy undertaken about 2 months after treatment shows a slight degree of thickening of the mucosa anteriorly at the level of the cervix and it is quite usual for the proctoscope to provoke a few spots of bleeding. Later proctoscopies usually show no abnormality. I feel it is too early as yet to say what is a normal degree of reaction, and what is indicative of high dosage, it is striking that chronic reactions have developed later in cases which showed no marked reaction immediately after treatment and contrariwise quite striking acute phenomena have not been followed by chronic reactions.

LATE RECTAL REACTIONS

My personal experience extends to almost 50 cases. Prior to January, 1937 I had seen 38 typical late radium reactions. Of these cases 33 had been treated at the Christie Hospital and Holt Radium Institute between 1931 and 1935 inclusive, 1 was treated in 1929 and the 4 others were treated in other institutions and referred to the Holt Radium Institute for diagnosis in 2 instances and for treatment as rectal carcinomas in the 2 others. Several

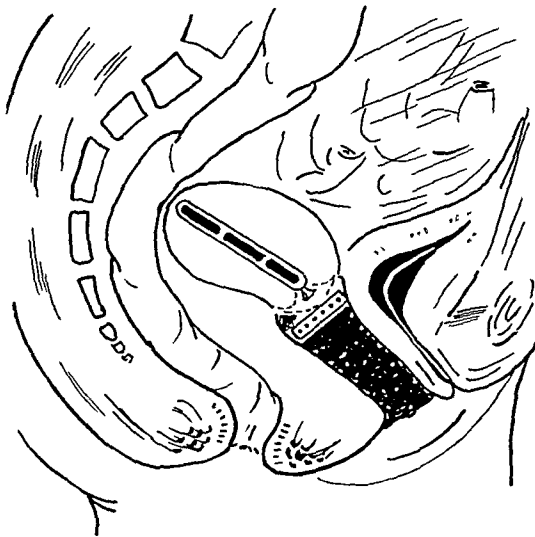


Fig 3 To illustrate the effect of retroversion

required in 1 case so far, and it was quite successful. But in the majority of cases, the ulcer heals completely without complications, and in time it is almost impossible to tell that there has been any trouble at all, save for a little residual thickening and fixity of the mucosa anteriorly.

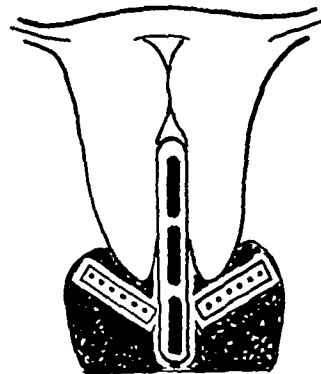


Fig 4 To illustrate the effect of slipping of the intra-uterine applicator (anteroposterior view)

B EXTRINSIC REACTIONS

The onset of symptoms is similar in these cases, and the two types cannot be differentiated on symptomatology alone. In some cases, pelvic pain is the first symptom, and may be sufficiently major to call for treatment *per se*. Another striking feature is the presence of considerable constitutional upset in the majority of extrinsic reactions.

On rectal examination, there is typically a thickening of the rectal wall 3 inches above

TABLE II—ANALYSIS OF 14 EXTRINSIC REACTIONS

Age	Stage of disease	Dose given (millicuries destroyed)	Time before first symptoms	Presence of pain	Complications	Present condition
56	I	66 mcd	6 mo	No	No	Well
53	III	72 mcd	5 mo	No	Rectovaginal fistula formed	Gradually occluding
53	II	74 mcd	1 mo	Yes	Rectovaginal fistula formed Colostomy required a/c pain	Well, with colostomy
39	II	80 mcd	9 mo	No	Rectovaginal fistula	Fistula gradually closing
50	IV	74 mcd	6 mo	Yes	Rectovaginal fistula	Fistula small not too troublesome
47	IV	70 mcd	24 mo	No	No	Well
49	III	57 mcd	5 mo	Yes	No	Died in 10 months from metastases
59	II	80 mcd	6 mo	No	Rectovaginal fistula	Well Very small fistula Has now closed
43	IV	79 mcd	10 mo	No	Stenosis, colostomy necessitated	Died from recurrence
61	II	70 mcd	10 mo	Yes	Stenosis, colostomy and sympathectomy required	Well, lesion resolving gradually
50	II	70 mcd	7 mo	Yes	Stenosis, colostomy and sympathectomy required	Well, lesion resolving gradually
56	III	47 mcd	4 mo	Yes	No	Well
60	II	60 mcd	14 mo	Yes	Sympathectomy required for severe pain No obstruction	Well, lesion resolving
57	II	86 mcd	6 mo	Yes	Colostomy for melena	Died from melena

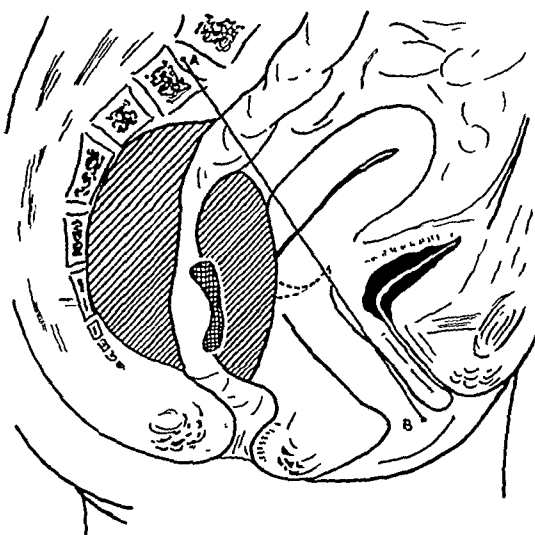


Fig 6 Diagrammatic representation of typical extrinsic reaction Cross hatch, ulceration, oblique lines, induration

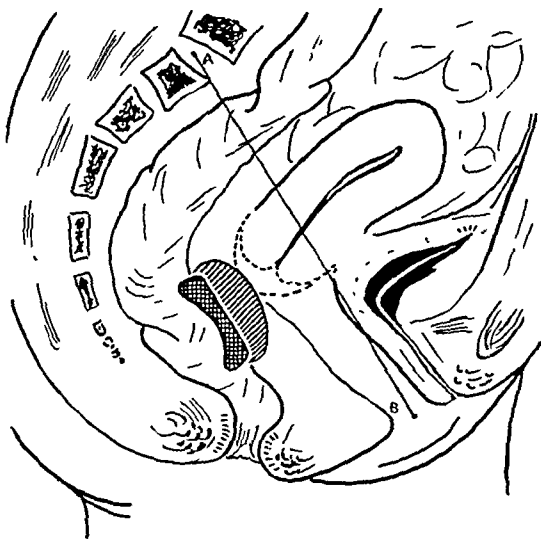


Fig 7 Diagrammatic representation of typical intrinsic reaction Cross hatch, ulceration, oblique lines, induration

the lumen not sufficient, though, to cause actual obstruction. Five colostomies were required in the 14 extrinsic reactions described in Table II.

Rectal hemorrhage is sometimes severe enough to require treatment because of actual loss of blood. In 1 case, this was sufficiently severe to require a colostomy. This was performed over a year ago, and the result has been excellent, there having been virtually no hemorrhage since the operation. I have already mentioned the patient who died from a sudden severe hemorrhage but this is, I think, exceptionally uncommon—I can find no other death from this cause reported in the literature.

Rectovaginal fistulas occurred in no less than 5 of the extrinsic reactions analyzed above. This represents an unduly high incidence, in no other of my cases has this complication occurred. In one of these cases, the fistula has nearly closed spontaneously, in another it has actually closed, and in the others the question of operative closure has been mooted, but the patients are not sufficiently inconvenienced by the fistulas to wish for operative treatment, even should such be considered likely to be successful.

Pain is a frequent concomitant of these lesions, and in some cases may be excessively

severe. In the intrinsic variety, pain is seldom marked, and is usually manifested as rectal discomfort after defecation. In the extrinsic variety, pain tends to be more frequent, and much more severe, though again there is a tendency for it to be precipitated by an action of the bowels. Its etiology is not known, but in view of the associated massive peri-rectal induration it seems reasonable to postulate an ischemic cause possibly comparable to the pain of a gangrenous limb. Also, the pelvic autonomic plexuses are invariably involved in the indurative process. I will describe later how the pain can be relieved by section of the appropriate sympathetic pathway.

All these complications are controllable, admittedly with some discomfort to the patient. The surgical measures taken for their relief are not necessarily permanent—I know of cases in which, following the performance of a colostomy, the rectal lesion cleared up sufficiently to allow the colostomy to be closed. The rectovaginal fistulas in many cases tend to close spontaneously also, and if they do not, there is always the remote possibility of surgical intervention if they are particularly incommoding. Severe melena would seem to be the complication the presence of which is most to be feared.



Fig. 5. Slipped applicator (lateral view.)

the anus, with a fixity of the whole rectum due to massive peri rectal induration. The pelvis feels as if frozen—once felt it would be difficult to mistake again. I have had the opportunity to feel the lesion from the abdomen in 5 cases in the course of a laparotomy, and the peri rectal solidity is again the most striking phenomenon. Another striking feature found on laparotomy is the localization of the induration to the posterior segment of the pelvis—if a plane is imagined from the front of the second sacral vertebra downward and slightly forward (A—B in diagrams) it is found that above and in front the pelvic tissues are unaffected while below and behind almost the whole of the structures are matted together in one massive indurative process. The uterus and parametria above the level of the cervix are not involved but the whole of the rectum passes through a tunnel of solid tissue binding it as it were, to the sacrum.

Per rectum the thickening of the wall is usually confined to a limited area of the anterior wall as in the other variety. An initial stage of granular proctitis is soon succeeded by mucosal ulceration and the formation of a diphtheritic slough. On sigmoidoscopic appearances it is not possible to differentiate the type of reaction as the mucosal changes appear similar but in this variety the peri rectal in-

durative process gradually occludes the lumen of the bowel as well as fixing it and distorting it, with the result that it becomes very difficult to pass the instrument more than a few inches. In the intrinsic type there is usually no difficulty in maneuvering the sigmoidoscope above the lesion, whereas once an extrinsic reaction becomes well established, sigmoidoscopic examination is extremely restricted.

The only lesion in any way similar is very advanced carcinoma of the rectum with wide extrarectal spread and fixity to the sacrum. In cases in which any doubt still exists after palpating the characteristic peri rectal solidity, a biopsy will again be conclusive. I am reluctant to take a section in these reactions because I feel that the additional trauma may retard healing, and in very few cases it is not possible to be sure of the diagnosis on clinical grounds alone.

The prognosis in this type is not quite so good as in the first variety. First and foremost it may be stated that it is very rare for the lesion to cause any mortality. I have seen only one patient die as a result of a rectal reaction and that was a patient on whom it had been necessary to perform a colostomy, because of the stenosis caused by peri rectal process. A few days after the colostomy had been opened a sudden severe and fatal hemorrhage occurred. But it does cause very considerable morbidity and whereas in the intrinsic variety the lesion usually heals spontaneously, and without any complications in this group it is frequent for some complication such as pain, rectal hemorrhage, rectal stenosis or rectovaginal fistula to develop, and to require treatment.

Rectal stenosis is the commonest complication. It may arise in two ways. The mucosal ulceration may be associated as in intrinsic reactions with submucosal granulation tissue, which may spread around the lumen and with organization cause stricture formation. More usually though stenosis occurs as a result of the external pressure from the mass of peri rectal fibrous tissue. In time complete obstruction may occur and necessitate the formation of a colostomy or the process may stop short of this with gradual healing of the mucosal ulceration and residual narrowing of

with either an unusual susceptibility of the rectal mucosa, as postulated by Laborde, or with an unusual juxtaposition of the radium applicator to the rectal wall—as can occur when an intra-uterine applicator slips into the posterior fornix. That this latter is a tangible etiological factor is borne out by the following observations I have made: 1 In 3 cases in which there was an intrinsic reaction situated higher than the usual site at the level of the cervix, skiagraphs taken with the radium *in situ* had shown that the uterus was retroverted, so that the intra-uterine radium impinged directly against the rectum at the level where the reaction later occurred. This association is too striking to be merely a coincidence.

The accompanying diagrams illustrate the effect of retroversion and slipping of the radium applicators in bringing the radium into closer juxtaposition to the anterior rectal wall.

2 In 4 cases with an extrinsic reaction, skiagraphs taken at intervals during treatment had demonstrated that the intra-uterine applicator had slipped out from the uterus and come to lie in the posterior fornix, above the gauze packing. In one or two other cases, I have noted that the vaginal applicators themselves have slipped, and come to lie above the packing. In either case there is inadequate distance protection of the rectum and the rectal mucosa in immediate proximity to the slipped applicator will receive a relatively high dose.

3 I have seen one case with an intrinsic reaction situated just 1 inch above the vaginal introitus. In such a situation it is difficult to imagine the occurrence of a reaction except due to one of the radium applicators becoming dislocated from its original position against one or other fornix and coming to lie directly against the posterior vaginal wall in this site. Tison (loc cit) and Jeanneney and Wangermez also stress the importance of slipped applicators, and I think one can claim that the resulting overdosage is at any rate one of the factors in the etiology of rectal reactions, and particularly in the intrinsic variety. In the cases in which the uterus is retroverted, should this not be discovered and allowed for, the actual dose delivered to the anterior rectal wall in an average case receiving the present scheme

TABLE III—SUMMARY OF SYMPTOMS, COMPLICATIONS, AND PROGNOSIS IN INTRINSIC AND EXTRINSIC REACTIONS

	Intrinsic	Extrinsic
Symptoms Tenesmus Diarrhea Pain Hemorrhage	Present Present Frequent Present	Present Present Frequent Present
Physical signs Ulceration Mobility Induration	Present Whole lesion mobile Very limited or absent	Present Absolute fixity Most striking feature is the amount of perirectal induration Pelvis typically "frozen"
Complications Stenosis Fistula formation	Uncommon Results in mobile fibrous stricture Uncommon	Common Due to external pressure Fixed and distorted canal Not infrequent
Prognosis	Spontaneous healing is usual	Treatment usually required for one or other complication Spontaneous healing does occur in minority of cases
Constitutional upset	Negligible	May be considerable

of treatment at the Holt Radium Institute is more than 2,000 roentgens greater than that received when the uterus is lying anteverted. Such an additional dose is easily capable of determining the occurrence of a late radiation reaction in a mucosa that would otherwise have received a dose well within the limit of tolerance. With slipped applicators, comparable or even higher doses would occur, and I think this factor of local overdosage is a very real one.

I postulate another etiological factor with especial regard to the extrinsic variety, namely, a widespread thrombosis of the blood vessels in the peri-rectal cellular tissues, induced by general radiation overdosage in the pelvis. (*En passant*, the question of overdosage is a relative one, several factors being concerned, such as the age and general health, the presence of arteriosclerosis, the total lymphocyte count, et cetera.) The morphology of this variety suggests a more general change in the pelvic tissues rather than a purely local one, and the vascular hypothesis now to be elaborated appears to be the most satisfactory one. It is not suggested that there is a distinct etiology for each type of lesion, but rather that different factors play parts of different



Figs. 8 and 9 Photomicrographs showing histological picture in specimen from patient dying of extrinsic reaction

Apart from these sequelae the prognosis is good, but the incidence of one or more of them is usual in the majority of extrinsic reactions. However, the ultimate prognosis even so is quite good, and as in the intrinsic variety, spontaneous healing tends to occur in time. There have been instances in which patients have been admitted into infirmaries to die of advanced cancer and the patient has recovered in the course of a few months to the amazement of all. The only tragedy to be guarded against is misdiagnosis in view of the likelihood of further radiation treatment being given with disastrous results.

In Table III the two types of reaction are contrasted in order to try to bring out the chief diagnostic and prognostic features.

It will be seen from Table III that the chief points of difference lie in the physical signs, the occurrence of complications and the presence of constitutional upset in one type.

ETIOLOGY

There are etiological factors which are common to both types of reaction and there are factors which appear to be specific. From 1913 onward, when radiation treatment became more and more generally used in the treatment of cancer of the cervix it has been widely known that too high doses of radium in the pelvis cause *inter alia* rectovaginal fis-

tulas. Improvements in technique and better knowledge of dosage relevant to local tissue tolerance have led to a gradual fall in the incidence of this complication till today it is very low. Gradual evolution of a rather different type of reaction seems to be occurring possibly associated with the fact that deep x-ray therapy is being more and more used, resulting in a more widespread and uniform dosage to the pelvis than was previously achieved with radium alone. Be this as it may, it is unquestionable that today the type of lesion met with is much more one of a diffuse tissue change in the pelvis generally—the extrinsic reaction—rather than a localized breaking down in the rectovaginal septum.

The only single factor that is commonly present still is that of high dose, although Bue and Malmgren (loc cit.) have described a case occurring after an intra uterine dose of only 800 milligram hours of radium in the treatment of fibroids. They report another case in which a total dose of 15,100 milligram hours was given (nearly twice as much as the average dose in our cases). The range of potential damage is almost as wide as the actual range of dosage in common use and it is equally apparent that other factors must be concerned as well.

If a dose of 800 milligram hours can precipitate a rectal reaction we must be dealing

by devascularization. It is well known that radiation tends to produce an endarteritic lesion in the tissues irradiated, and the poorly vascularized peri-rectal tissues are no exception to this. To quote Pullinger "irradiation sets in train in the lumen of blood vessels a process which, by itself, is sufficient to bring about cell death on a large scale." It is conceivable that thrombosis of some of the smaller radicles of the hemorrhoidal vessels may spread to the other vessels in the irradiated area until finally the bigger trunks are occluded with subsequent infarction. Certainly the two striking morphological features are the occurrence of the mucosal ulceration at the portion of mucosa with the poorest blood supply, and the localization of the peri-rectal mass to the posterior relatively avascular segment of the pelvis. The histological evidence of vascular thrombosis would seem to clinch the argument in favor of the hypothesis submitted.

Other possible etiological factors are the presence of infection and the pre-existence of parametrial infiltration. The possible significance of infection is a moot point. Infection exists in the vast majority of cases of cervical cancer before treatment is instituted, making it impossible to deny that it may play some part. Clinically I have never noticed anything striking in this respect in these cases during treatment, whereas the tendency for pelvic infections to be flared up by treatment is widely known. Pyrexia of low degree during treatment is frequent, and the absence of a rectal reaction in any particular case might just as well be attributed to this factor. It is true that once a reaction has manifested itself, there is frequently a low grade pyrexia, but this is associated with mucosal ulceration, and the inevitable secondary infection that then occurs, though leucocytosis is unusual in these cases. I think it is doubtful whether infection plays a rôle of any importance, though in the presence of infection any fibroblastic reaction in the peri-rectal tissues would be markedly exaggerated.

Berard and Cressel emphasize the presence of parametrial infiltration before treatment as an important etiological factor, and Bailey also stresses its importance. However, I cannot confirm this view in the cases I have

seen. In 2 cases there was no clinical sign of infiltration in either broad ligament prior to treatment, and in at least 6 other cases that I have seen the parametrial infiltration before treatment was minimal. The same criticism applies to the suggestion of Mugniery that the extrinsic variety is a peri-rectitis due to irradiation of the parametria and uterosacral ligaments previously infiltrated with new-growth. That this is present in a few cases is undeniable, but it is equally true that it does not apply to many more. The occurrence of a peculiar type of ligneous infiltration following radiation is known in other situations besides the pelvis—it is commonly seen in the breast, for example, where the question of infection or pre-existing infiltration does not arise.

I would summarize by saying that the only proven etiological factor is the occurrence of local accidental overdosage in the cases with an intrinsic reaction, when the resulting lesion is a local tissue necrosis, exactly comparable to radiation necrosis elsewhere. In the cases with an extrinsic reaction I submit a hypothesis that the lesion is essentially a gangrene following post-irradiation deprivation of blood supply to the posterior segment of the pelvis, rather than a local tissue necrosis due to the direct action of the specific agent. The localization of the lesion is dependent upon several anatomical and morphological factors which have been detailed.

PATHOLOGY

No case of intrinsic reaction has come to postmortem examination, but an autopsy was obtained on the case of extrinsic reaction in which the patient died from hemorrhage. From the abdomen the contents of the posterior part of the pelvis were seen to be fixed in a tumor-like mass of firm, hard tissue. In front the mass was attached to the lowermost part of the uterus. It spread for approximately 2 centimeters into the lower part of the right parametrium, and 3 centimeters into the left. It was then reflected backward on to the anterior surface of the sacrum, to which it was firmly adherent from the second sacral vertebra above to just above the tip of the coccyx below. The mass was enveloping, adherent to, and constricting the rectum, whose lumen was

importance in the particular instances. In the intrinsic lesions, the pathology is limited to a localized area of the rectal wall while in the extrinsic lesions it has spread widely into the pelvic cellular tissue. That the two types are essentially the same pathologically is shown by the following observations:

a. In some cases the peri rectal induration has preceded the mucosal ulceration.

b. In others, an intrinsic reaction has gradually spread into the adjoining cellular tissue so that when re examined after a few months, the case would be classed as a typical extrinsic reaction.

Therefore I suggest that the type of reaction depends on other factors such as local overdosage from slipped applicators, which, in the absence of an x ray course, will tend to cause an intrinsic reaction, or too high a dose to the pelvis generally (x rays plus radium), which will cause endarteritic changes in the pelvic cellular tissue with secondary stranguation of the blood supply to the rectal mucosa. The effect on the latter is similar in each instance. It stands to reason that given a precipitating factor capable of causing endarteritic phenomena the pathological process may commence at any area of the affected tissues (in this instance the pelvis). Naturally this will tend to occur where the precipitating factor is most concentrated which is in accordance with the observed phenomena.

1. The morphological appearances are those of necrosis.

2. The region of the rectum affected primarily in practically all cases is to a certain extent, a junctional one as regards its blood supply. This implies the presence of smaller tributaries than elsewhere, and this presupposes easier vulnerability. In addition the blood supply to the rectum is more abundant posteriorly than anteriorly. This fact plus the approximation of the anterior rectal wall to the radium applicators is probably responsible for the constant anterior localization of these lesions.

3. In the majority of intrinsic reactions, the lesion is localized to this anastomotic area which corresponds approximately to that portion of the rectum nearest to the vaginal vault and consequently to the radium applicators.

In exceptional cases the lesion occurs at some other site, and then the presence of some other factor—such as *retroversion*—can be shown to play a part.

4. In the extrinsic reactions it is very noticeable that the peri rectal mass that results is always localized to the posterior segment of the pelvis. Vaginal examination will demonstrate that the anterior half of the pelvic cavity is free, and that the uterus is frequently mobile, but on rectal examination the typical lesion is palpated as a hard mass fixing the rectum to the hollow of the sacrum. This localization is most strikingly seen at laparotomy (and also in the case that came to autopsy) when the mass is found to surround the lower two thirds of the rectum, filling in the sacral hollow completely, and extending upward as high as the third or even second sacral vertebra and the whole being absolutely fixed. The uterus is lying anteriorly and quite free from the mass, and the upper parts of the broad ligaments are also quite free.

A little consideration makes one realize that this area of the pelvis has a very limited blood supply—in fact the only vessels in it of any size are the branches of the superior and middle hemorrhoidal arteries, the small middle sacral artery, and the lateral sacral arteries on the bony wall of the pelvis. Away from the bony walls the only vessels are the branches of the hemorrhoidals and the only viscus is the rectum. On anatomical grounds it seems reasonable to me to suggest that the whole lesion is due to an occlusion of these vessels, with the production of a type of infarction of the whole posterior segment of the pelvis. It is known that radiation can cause vascular occlusion, and in this site, *par excellence*, there is extreme poverty of collateral circulation, so that once occlusion occurred infarction would be almost inevitable.

5. The histological evidence to hand is certainly in favor of this theory. The only characteristic feature found in the section taken through the rectal wall and adjoining tissues was thrombotic occlusion of most of the vessels seen, with recanalization in a few. The hard tissue of the mass is seen to be fibroblastic tissue—seemingly a granulomatous response to local tissue damage presumably.

cause too much discomfort at first, but the oil instillations give relief, and they are more easily retained if the foot of the bed is elevated. The other important thing to bear in mind is the necessity of getting a regular and soft action of the bowels.

Alternative methods of treatment are the use of diathermy and the making of a colostomy. Diathermy is used on the Continent, and dramatic results are claimed, but I have no personal experience with the method. Colostomy is theoretically ideal, and I know of cases in which it has been done with very gratifying results, the lesion healing, and the colostomy being closed in a few months. I think that its use could be more often advocated in non-obstructive cases.

b. Treatment of complications The complications calling for treatment are stenosis, hemorrhage, and pain.

1 *Stenosis* Once stenosis occurs to any marked degree, a colostomy is imperative. This colostomy need not necessarily be permanent, as the stenosis may lessen with gradual resolution of the lesion, but in the majority of cases it will have to remain open. I doubt if these cases would lend themselves to any sort of excisional or reconstructive surgery in the pelvis.

2 *Hemorrhage* Colostomy is also the only satisfactory treatment of recurrent bleeding. Hemorrhage tends to cease once feces are not constantly passing over the ulcerated surface. I have seen only one case in which such a drastic measure was required.

3 *Pain* This can be the most serious symptom in these cases, and often calls for relief *per se*. In the majority of cases the tenesmus and the discomfort after evacuation of the bowels are relieved shortly after the commencement of wash-outs and instillations, but there is a severer type of pain which can occur and form a separate problem by itself. This pain is deep-seated in the hypogastrium and pelvis, is burning in nature with intermittent colicky exacerbations, and often likened to a bearing-down pain. It is often severe enough to prevent sleep. It is usually precipitated by an action of the bowels, though between such exacerbations it tends to persist as a dull ache. Radiation may occur to the front and sides of the

thighs, but the pain is mostly restricted to the hypogastrium and lowermost part of the back. Really severe pain of this nature occurs more frequently in the extrinsic reactions.

The primary indication for treatment here is relief of pain. I have obtained relief by one or other of two distinct measures, or by a combination of both. Shortcircuiting of the lesion by colostomy, or section of the afferent nerve supply to the rectum will abolish the pain, either alone will suffice, but to my mind there is a considerable argument for combining the two procedures on the grounds, particularly in the usual extrinsic reactions, that quicker resolution of the lesion should result—shortcircuiting allows more rapid healing of the ulcerated mucosa, while presacral sympathectomy appreciably increases the pelvic blood supply, and should, *pari passu*, accelerate the resorptive process. To date I have carried out these procedures on 7 patients. (The actual operations in 4 of the cases were carried out by Professor E. D. Telford, and Mr H. T. Simons, to both of whom my grateful thanks are tendered.) The therapeutic effect in each case as regards pain relief has been most dramatic, being immediate and permanent, but it is yet too early to comment on the effect on the healing process, though I think resolution is occurring rapidly. The laparotomies have also afforded opportunity to examine the lesions from within, as described. A fair estimate of the severity of the pain in these patients is obtained by studying their willingness to undergo such a major operation for its relief.

The following are brief case histories of the patients on whom presacral sympathectomy has been carried out.

CASE 1 Mrs M. E. R., aged 61 years, had been treated with x-rays and radium for a stage II carcinoma of the cervix in February and March, 1935. She had been well for 10 months, when hemorrhage and severe bearing-down pain occurred. Examination showed a typical extrinsic reaction. Because of the continuance of hemorrhage and the severity of the pain, it was decided to do a colostomy and sympathectomy in February, 1936. The result was cessation of bleeding and immediate relief of pain. This has persisted to date, the rectal mucosa is healing, and the peri-rectal mass is softening. It is hoped to close the colostomy later.

CASE 2. Mrs F. H., aged 40 years, had been treated with x-rays and radium for a stage II carci-

linked and difficult to find. The tissue mass cut with a gritty feeling exposing a surface showing small islands of fat lying in the interstices of a thick, glistening mass of pleomorphic fibrous strands.

On the anterior wall of the rectum opposite the cervix was an ulcer—3 centimeters by 2 centimeters—with heaped up and rather undermined edges, and a grayish, sloughing base. The surrounding rectal mucosa was rather indurated and thickened and granular in appearance.

HISTOLOGY

In the rectum the base of the ulcer showed a total loss of mucous membrane. Toward the edge of the ulcer some mucosa was seen, recognizable as such in the depths of the crypts, but more superficially represented by a hyaline reticulum containing a few pycnotic nuclei, plasma cells, and lymphocytes. In the submucosa there was an intense plasma cell infiltration, among which were scattered a few eosinophil polymorphonuclears. The arteriolar walls showed some medial thickening, and a severe endarteritis, in many cases leading to complete occlusion of the lumina. The muscular coats were sparsely infiltrated with plasma cells, and the arterioles showed the same changes as the vessels of the submucosa. The adventitia presented much the same picture as that seen in the submucosa, the salient features being the plasma cell infiltration and obliterative arteriolar changes with a few scattered eosinophils and lymphocytes.

Further away from the adventitia the congregation of plasma cells diminished and young fibroblasts began to be present in increasing numbers. Further out still—now in the actual peri rectal mass—the plasma cell element disappeared quite sharply and a typical field showed an odd islet of fat surrounded by a relatively avascular fibrous tissue with a hyaline appearance. Fibrous tissue cells were scanty, an occasional lymphocyte was seen, and a very occasional new formed blood vessel. Where present these latter showed none of the obliterative characteristics seen in the rectal vessels. In places the fibrous tissue enveloped small vessels, the lumina of which were occluded by old thrombi, but were under going a process of recanalization.

The general picture in the peri rectal mass suggests an indolent granulation tissue response, such as might be called forth by a process of infarction. It is difficult to imagine any resolution occurring in view of the poor blood supply, and the end result should be an avascular cicatrix, probably stenosing the rectum almost entirely. The rectal ulceration, however, does not resemble any specific process, but is more suggestive of an ischemic necrosis of epithelium—a view supported by the underlying endarteritic phenomena. These findings are completely in accord with Pullinger's experimental demonstration of thrombosis following irradiation of normal tissues.

Study of the histology of this reaction seems to confirm the theory I put forward as regards the etiology of the condition. I have suggested that a spreading obliterative endarteritic process occurring in the relatively poorly vascularized posterior segment of the pelvis would produce an ulceration in the rectum as a result of deprivation of its blood supply in that particular region where the process was most marked. The histological appearances are those of widespread vascular occlusion, associated with the formation of a mass of avascular fibrous tissue forming yet another barrier between the rectal mucosa and its source of blood supply. The histology also suggests one line of treatment that might be of some value—sympathectomy should revascularize the affected zone to a certain extent at any rate, and possibly avert the avascular cicatrix that would otherwise seem to be inevitable.

TREATMENT

Treatment will have to be discussed under the headings of the treatment of the actual lesion itself and the treatment of the complications of the lesion.

a Treatment of the rectal lesion. The standard method of treatment (Hurdon) is to give bowel wash-outs twice daily with saline or some weak antiseptic introduced no hotter than can be comfortably tolerated. Each injection is followed by the instillation of as many ounces of liquid paraffin as the patient will tolerate (average 4 to 6) the patient being kept in bed for the duration of the treatment. In some of the severer cases the wash outs

canth mucilage, this again is clearly seen in skiagraphs.

With the added experience gained from a detailed study of these reactions, the various accessory methods of investigation described, and a due regard for the prophylactic points to be enumerated, it should be possible to reduce the incidence of late or chronic reactions—already less than 5 per cent—to a purely nominal figure

1. In order to utilize to the full the possibility of obtaining distance protection from the rectum, all vaginal applications of radium should be made with the patient in the knee-chest position

2 The lips of the cervix, or a portion of the growth, should be sutured over the intra-uterine tube to ensure that it does not slip into the vagina, or alternatively, a special type of applicator devised to prevent this complication, should be used.

3 A locking device for the vaginal applicators should be used in order to prevent slipping and approximation

4 Repeated skiagraphs should be made during treatment to ensure that the position of the applicators remains constant, if slipping occurs, it is recognized, and the radium can be removed before damage is done

5 In the presence of retroversion, the intra-uterine dose should be reduced, or the distal needle omitted in subsequent applications

6. A special applicator should be used during x-ray treatment to limit the amount of radiation delivered to the rectum

7 Routine blood counts during treatment will demonstrate any marked constitutional effect due to the radiation. A pronounced lymphopenia should indicate the advisability of stopping treatment.

8 Preliminary proctoscopy will show whether or not the rectal mucosa is normal before radiation. Should rectal symptoms occur during treatment, proctoscopy will show whether or not there is any excessive reaction, and will decide whether the continuance of treatment is safe

SUMMARY

The occurrence of ulceration of the rectum following irradiation treatment of carcinoma

of the cervix has been described. The lesions resemble carcinoma on digital examination, and hence have been named "pseudocarcinoma of the rectum." Their morphology has been detailed, two distinct types being found, one of which is restricted to the rectal wall, while the other appears to involve mainly the peri-rectal tissues, with secondary involvement of the rectum. Diagnosis is made on the clinical features, plus a history of previous irradiation, and it is confirmed, when necessary, by a biopsy.

The etiological factors have been discussed, and it has been shown that many cases are associated with local overdosage in the vaginal vault. There is no other common factor recognized. The histology of both types of lesion have a striking feature in common, namely, vascular occlusion throughout, and it is suggested that this phenomenon may be the vital one concerned—irradiation causing thrombosis in some of the smaller branches of the hemorrhoidal vessels, and this spreading leads to obliteration of the blood supply of the rectum in the junctional region, followed by the occurrence of infarction and mucosal ulceration.

The favorable prognosis in most cases is described, and the varieties of treatment of the complications that may be called for are indicated. Finally, several technical details that may be influential in avoiding the occurrence of these complications are listed.

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noma of the cervix in August and September 1935. She had been well for 7 months when hemorrhage and severe pain after defecation commenced. Examination showed a typical extrinsic reaction. Pain persisted and was very severe. A sympathectomy was done in May 1936. This resulted in immediate and almost complete relief. The lesion produced gradual occlusion of the rectum necessitating colostomy in September 1936. Patient has been much improved, is gaining weight and is free from pain. The rectal mucosa is healed, but lumen is still stenosed though the fibrous obstructing mass is definitely softening.

CASE 3. Mrs. H. H., aged 37 years, had been treated with x rays and radium in April and May, 1936, for a stage II carcinoma of the cervix. In middle of x ray course patient complained of some tenesmus but was unfortunately not proctoscoped then although the treatment was curtailed as a safeguard. Low grade intestinal obstruction followed with gradual distention. In 2 months a typical extrinsic reaction had developed and there was much associated pain. Patient's general condition was so poor that it was deemed advisable to do only colostomy first; this was done in August 1936. Three weeks later as pain was still severe and as her general condition was better sympathectomy was done. Pain relief was not striking at first owing to large functional element but within 3 months it had completely disappeared. Patient had gained weight and the rectal mucosa was healing when pelvic recurrence of her malignancy killed her 1 year later.

CASE 4. Mrs. E. M., aged 54 years, had been treated with x rays and radium in February and March 1936 for a stage III carcinoma of the cervix. She had been well for 6 months when colicky pain and hemorrhage commenced and examination revealed a typical extrinsic reaction. Pain was very severe and rectal stenosis was already present so colostomy and sympathectomy were done in October 1936. Result was immediate relief of pain. Very marked resolution has occurred and already the stenosis has largely disappeared. Closure of the colostomy has once been carried out (February 1938, by Mr. H. T. Simmons).

CASE 5. Mrs. M. S., aged 48 years, was treated with radium and x rays from October to December 1936 for a stage II carcinoma of the cervix. Six months later subacute obstruction of the rectum occurred, necessitating a colostomy. Presacral neurectomy was done at the same time. Following a satisfactory convalescence the patient was discharged. Nine months later (February 1938) her doctor reported her condition as quite satisfactory.

CASE 6. Mrs. A. A., aged 60 years, was treated with x rays and radium in September and October 1935 for a stage II carcinoma of the cervix. Twelve months later she developed a definite extrinsic reaction which chiefly caused considerable pain. There was but little stenosis so sympathectomy alone was done. Nine months after this the pelvis was appreciably softer, no obstruction had developed and the patient was free from pain.

CASE 7. Mrs. A. C., aged 51 years, was treated with radium and x rays for a stage III carcinoma of the cervix in December 1936 and January, 1937. She was well for 9 months when sudden onset of diarrhea and rectal hemorrhage occurred. Extrinsic reaction developed and pain became a predominant symptom. No definite stenosis as yet but from rapid development of peri rectal mass it is very probable soon. Presacral sympathectomy was done January 1938 with immediate and lasting relief of pain. No colostomy has been required as yet.

It will be seen that in 5 cases, sympathectomy has been combined with colostomy, and the argument for sympathectomy rests on Cases 2 and 3. In Case 2, sympathectomy was done alone first, and produced complete pain relief, but colostomy was necessitated later because of rectal stenosis. In Case 3, the colostomy was done first and produced no pain relief. Sympathectomy was again successful. I think sympathectomy alone is justified in a reaction causing severe pain and not associated with rectal stenosis, as in Case 6, though in the few cases met with the two symptoms will probably both occur, and require the double therapy. In Case 7 (as in Case 2) a preliminary sympathectomy has been done in the presence of considerable peri rectal induration not as yet producing stenosis, in the hope that resolution of the indurative process may be accelerated and stenosis prevented.

PROPHYLAXIS

From the argument so far it is obvious that avoidance of high dose effects in the pelvis will go far to eliminate the incidence of the complications almost completely, but the essential need in the treatment of cervical cancer is, while avoiding these, to deliver as high a dose as possible to the pelvis. I have elaborated several methods of investigation whereby the actual dose of radiation delivered to the rectal wall may be estimated. In an occasional case in which a laparotomy was indicated for some reason or other, I have implanted an empty gold seed in the muscle coat of the rectum; this is clearly visible in subsequent roentgenographs, and shows the proximity of the anterior rectal wall to the vaginal and uterine radium. Alternatively, the anterior rectal wall may be delineated by smearing it through a proctoscope with a barium triga-

canth mucilage, this again is clearly seen in skiagraphs.

With the added experience gained from a detailed study of these reactions, the various accessory methods of investigation described, and a due regard for the prophylactic points to be enumerated, it should be possible to reduce the incidence of late or chronic reactions—already less than 5 per cent—to a purely nominal figure

1 In order to utilize to the full the possibility of obtaining distance protection from the rectum, all vaginal applications of radium should be made with the patient in the knee-chest position

2 The lips of the cervix, or a portion of the growth, should be sutured over the intra-uterine tube to ensure that it does not slip into the vagina, or alternatively, a special type of applicator devised to prevent this complication, should be used

3 A locking device for the vaginal applicators should be used in order to prevent slipping and approximation

4 Repeated skiagraphs should be made during treatment to ensure that the position of the applicators remains constant, if slipping occurs, it is recognized, and the radium can be removed before damage is done

5 In the presence of retroversion, the intra-uterine dose should be reduced, or the distal needle omitted in subsequent applications.

6. A special applicator should be used during x-ray treatment to limit the amount of radiation delivered to the rectum

7 Routine blood counts during treatment will demonstrate any marked constitutional effect due to the radiation. A pronounced lymphopenia should indicate the advisability of stopping treatment.

8 Preliminary proctoscopy will show whether or not the rectal mucosa is normal before radiation. Should rectal symptoms occur during treatment, proctoscopy will show whether or not there is any excessive reaction, and will decide whether the continuance of treatment is safe

SUMMARY

The occurrence of ulceration of the rectum following irradiation treatment of carcinoma

of the cervix has been described. The lesions resemble carcinoma on digital examination, and hence have been named "pseudocarcinoma of the rectum." Their morphology has been detailed, two distinct types being found, one of which is restricted to the rectal wall, while the other appears to involve mainly the peri-rectal tissues, with secondary involvement of the rectum. Diagnosis is made on the clinical features, plus a history of previous irradiation, and it is confirmed, when necessary, by a biopsy.

The etiological factors have been discussed, and it has been shown that many cases are associated with local overdosage in the vaginal vault. There is no other common factor recognized. The histology of both types of lesion have a striking feature in common, namely, vascular occlusion throughout, and it is suggested that this phenomenon may be the vital one concerned—irradiation causing thrombosis in some of the smaller branches of the hemorrhoidal vessels, and this spreading leads to obliteration of the blood supply of the rectum in the junctional region, followed by the occurrence of infarction and mucosal ulceration.

The favorable prognosis in most cases is described, and the varieties of treatment of the complications that may be called for are indicated. Finally, several technical details that may be influential in avoiding the occurrence of these complications are listed.

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THE NON-SURGICAL TREATMENT OF HYPERTHYROIDISM COMPLICATING HEART DISEASE

WILLIAM W. NEWMAN, M.D., and L. HENRY GARLAND, M.D. San Francisco, California

ABOUT a year ago we suggested to a fellow internist that a certain patient suffering from hyperthyroidism complicating heart disease be treated by roentgen irradiation of the thyroid gland, a method which we have been using for some years. Our colleague informed us that he considered this form of therapy entirely useless and that it had been abandoned, not only by the medical staff, but also by the x-ray department of his institution. Since we have respect for this man's opinion, his remarks challenged us to attempt to determine if the results which we had been getting from the x-ray treatment of hyperthyroidism were really as satisfactory as we had thought, or whether we were being completely deluded in regard to them.

Cursory perusal of the literature made it obvious that many physicians of good repute think well of the method. As early as 1902, Williams (14) spoke favorably of the irradiation treatment of goiter and in 1908 Pfahler (9) reported the treatment of several cases with good clinical results, as did Means and Aub in 1917. Williams (13) in *Radiology* for 1932, reporting two hundred of his own cases, gives a bibliography of some 75 articles published between 1925 and 1930 all dealing specifically with this subject and most of them reporting favorably. Many of the more recent reports are well supported with objective data such as basal metabolic rate, weight, pulse rate, etc. A very few of the best substantiated of these are included in Table I.

In the face of such a voluminous and generally favorable literature on the subject it would seem superfluous to report a small series of 28 cases were it not for the fact that there is still considerable difference of opinion in regard to the effectiveness of the x-ray treatment of hyperthyroidism.

Patients suffering from hyperthyroidism complain of symptoms chiefly from two

sources: (a) the central nervous system, in the form of nervousness and tremor, and (b) the cardiovascular system, in the form of palpitation of the heart and, perhaps, shortness of breath or chest pain on exertion. It is not surprising, therefore, that a few patients with uncomplicated hyperthyroidism arrive in the office of the cardiologist. Moreover, the increased circulatory demands of the hyperthyroid state often makes incompetent a somewhat damaged heart that otherwise would not, at that time at least, show evidence of failure. Thus, the cardiologist sees Graves' disease both with and without organic heart complications.

It is beyond the scope of this paper to go into the details of the diagnosis of hyperthyroidism complicating heart disease as we are here concerned chiefly with treatment. It is the overactivity or perverted activity of the thyroid gland and not its enlargement (which may or may not also be present) that is chiefly responsible for thyroid disease and which we attempt to correct. We do not try to differentiate between toxic thyroid adenoma and diffuse hyperplasia, since we believe that these two conditions often co-exist in the same gland and nothing is gained at least as far as therapy goes, in attempting their, perhaps, artificial separation.

In a patient with heart disease we are led to suspect a possible hyperthyroid complication if he has unaccountably lost weight in spite of a good appetite, is excessively nervous and sweaty, has a pulse rate more rapid than one would anticipate from the degree of heart disease present, or has some of the physical signs of hyperthyroidism such as prominent eyes, fine tremor, goiter or auricular fibrillation without obvious cause. If any of the foregoing signs or symptoms make us even vaguely suspicious that the thyroid gland is overactive we take a basal metabolism test and repeat the test if necessary, on

TABLE I—A FEW OF THE MANY RECENT REPORTS ON X-RAY TREATMENT OF HYPERTHYROIDISM

Year	Author		Cases	Cured %	Im- proved %	Satis- factory %
1935	Quiney	(11)	73	89.7	81	97.8
1934	A. M. Smith	(12)				76.0
1936	Harris & Rose	(5)	193			67.0
1932	Williams	(13)	200	80.5	13.5	84.0
1932	Menville (questionnaire to 200 radiologists)	(8)	10,541	66.22	21.07	87.0
1934	Pfahler	(10)	440	57.3	30.6	87.0

subsequent days until we are satisfied that a reliable rate has been determined

Heart disease may so mask the usual signs and symptoms of hyperthyroidism that we have come to rely greatly on metabolism testing to make the diagnosis of thyroid heart disease, much as we rely on the Wassermann test in the diagnosis of syphilitic heart disease. Unfortunately, however, the basal metabolism test is much less reliable than is the Wassermann, and therefore we must be very sure of our laboratory and of all the conditions under which the test was taken. The most important point is that the test be made by a careful and tactful technician who can gain the apprehensive patient's confidence and co-operation. It is futile to attempt a test on an orthopneic patient or one in any other distress. All the basal metabolism tests on the patients here reported were done in one laboratory by the same technician, who has completed over 3500 tests and whose work we feel is most reliable.

During the past several years we have made a definite diagnosis of hyperthyroidism on private patients directly under our care 33 times. Of these, 2 left our control and were operated upon elsewhere, 2 more took only one treatment and were seen no more, and the datum on 1 other is entirely inadequate. This leaves a total of 28 unselected patients who were treated by the method described.

The type of patient met with is outlined in Table II.

Once the diagnosis is established treatment is begun at once. The patient is treated am-

TABLE II—CLASSIFICATION OF 28 PATIENTS

Sex	Number	Percentage
Women	19	68
Men	9	32
Organic heart complications		
None	4	14
Rheumatic	6	21
Degenerative	16	57
Lues	1	3
Undetermined	1	3
Auricular fibrillation	11	39

Age Range 22 to 72 years, average 50 years.
Basal metabolic rate Range plus 14 per cent to plus 70 per cent, average plus 35.1 per cent.

bulatorily unless severely decompensated and is thus usually able to continue with his household or business duties. Digitalis and perhaps quinidine is used if auricular fibrillation is present. Luminol or bromide is usually necessary for nervousness, and diuretics, such as salyrgan, may have to be used at first if the patient is waterlogged. Iodine in the form of Lugol's solution, 5 to 10 drops three times a day, is uniformly prescribed from the start. It is our opinion that these measures are of importance only in ameliorating the symptoms until irradiation of the thyroid starts to show its effect, which usually takes place in from 3 to 6 weeks. The patient is sent to the radiologist who is given the essential data on the case and the details of the irradiation are left entirely in his hands. Treatments have usually been given at intervals of from 3 to 7 days, and we anticipate beginning to see results by the sixth treatment at which time we usually repeat our basal metabolism. If the rate is approaching the plus 10 per cent mark by this time, we may discontinue irradiation; as a rule, however, a complete course of about 12 treatments is necessary, and this is about the average number given to each patient in this series. We have had no complications from the treatment except for a slight and transient sensation of burning over the skin of the neck, a little dryness of the throat, or hoarseness.

Radiation therapy in patients suffering with hyperthyroidism has been directed to both the pituitary and the thyroid glands. Experimentally, Epifanio and Cola have shown that large doses of irradiation administered to the pituitary gland of experimental animals caused atrophy of the thyroid and thymus.

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sources (a) the central nervous system, in the form of nervousness and tremor, and (b) the cardiovascular system, in the form of palpitation of the heart and, perhaps, shortness of breath or chest pain on exertion. It is not surprising, therefore, that a few patients with uncomplicated hyperthyroidism arrive in the office of the cardiologist. Moreover, the increased circulatory demands of the hyperthyroid state often makes incompetent a somewhat damaged heart that otherwise would not, at that time at least, show evidence of failure. Thus, the cardiologist sees Graves' disease both with and without organic heart complications.

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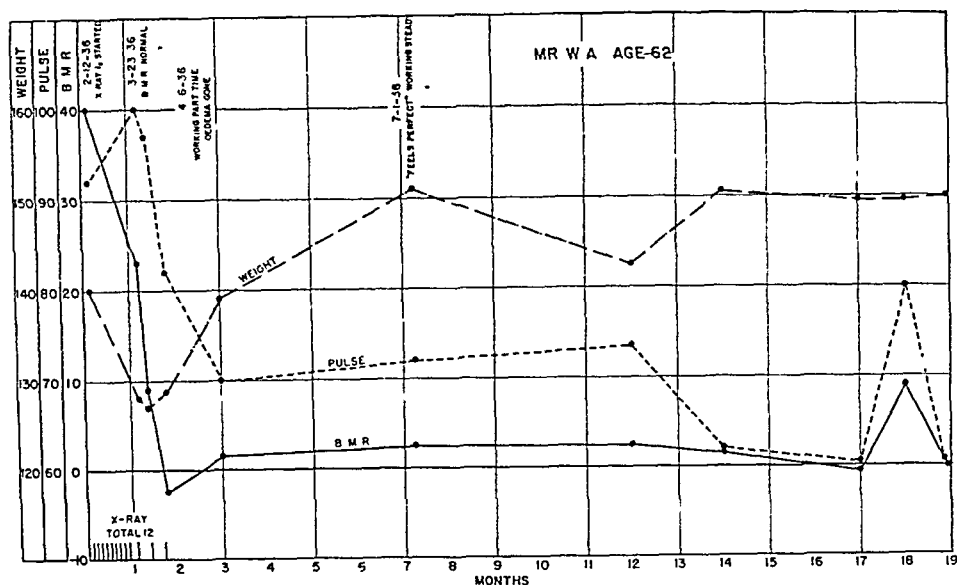


Fig 2 Weight, pulse, and metabolism record in Case 1

refractory ones submitted to operation. Approximately 70 per cent of all cases of hyperthyroidism properly irradiated will show clinical cures. The present "resistance" of many physicians to the treatment of hyperthyroidism by irradiation is analogous to the "resistance" of surgeons to the treatment of carcinoma of the cervix by irradiation in former days. It has now been thoroughly shown that a slightly higher percentage of all cases of carcinoma of the cervix can be cured by irradiation than can be cured by surgery, and with a far smaller mortality. Similarly, although the operative mortality in thyroidectomy is quite low, the irradiation mortality

is negligible and the method, therefore, clinically superior for use in appropriate cases.

Our present technical factors are as follows:

Medium or high voltage (125-200 kilovolts), moderate filtration (0.25-0.5 millimeter copper plus 1 millimeter aluminum), half-value layer 0.3-0.9 millimeter copper, target-skin distance 25-50 centimeters, skin fields 14-17 centimeters diameter, a narrow strip of lead rubber over larynx and trachea (2 by 12 centimeters), one single anterior field. To this field is administered from 150 to 200 r/air every second or third day, up to a total dosage of approximately 2000 r/air.

TABLE V — "CURED" GROUP—17 PATIENTS, OR 60 PER CENT OF TOTAL

Observation period average—2 years, 10 months

	Average B M R %	Weight pounds	Pulse	% with B M R +10 or less
Initial	+35.4	139	90	0
Final	-6	149	68	100
Change	41*	10†	22‡	
Within 3 months	+5	144	73	53
Within 1 year	-3	148	69	94

*Drop †Gain ‡Beat drop

CRITERIA (1) Disappearance of the symptoms of hyperthyroidism, (2) economic restitution, (3) basal metabolic rate of +10 per cent or below, (4) basal pulse rate of 80 or below, (5) gain of weight to near former average.

TABLE VI — "IMPROVED" GROUP—8 PATIENTS OR 28 PER CENT OF TOTAL

Observation period average—2 years

	Average B M R %	Av weight pounds	Av pulse
Initial	+34.5	144	87
Final	+14	145	78
Change	20*	1†	9‡
Within 3 months	+16	145	74
Within 1 year	+13	149	78

*Drop †Gain ‡Beat drop

CRITERIA (1) Definite improvement in the symptoms of hyperthyroidism, (2) economic restitution, (3) a distinct reduction in basal metabolic rate although usually not to normal together with usually a gain in weight and drop in pulse rate.

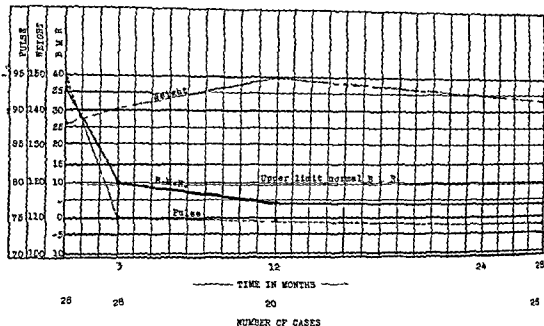


Fig. 1. Diagram showing behavior of basal metabolic rate, weight, and pulse rate under irradiation. Average of all cases treated—25.

Borak and others have reported favorable results from irradiation of the pituitary in patients with hyperthyroidism. One of us has had limited experience with this method in clinical practice, but not yet sufficient to warrant definite conclusions.

Eckert and others have shown that definite histological changes consistent with clinical results, occur in the hyperplastic or abnormal thyroid following adequate dosage of irradiation. New experimental work on this subject is detailed extensively by Harris in a recent comprehensive article. It has been conclusively shown that adequate doses of irradiation may be safely applied to the thyroid

without producing either serious skin changes or hypofunction of the normal parathyroid glands. Further, Lahev and others have shown that it is no more difficult to extirpate the thyroid should such be necessary, in patients who have had proper irradiation than in patients who have not been irradiated.

As regards the irradiation therapy of hyperthyroidism generally (as distinct from the therapy of cardiac hyperthyroid patients) it is our impression that (1) acute, rapidly progressive hyperthyroidism and (2) chronic cases of hyperthyroidism with large, nodular goiters may well be subjected to surgery immediately, (3) all other cases of hyperthyroidism may well be irradiated and only the

TABLE III—RESULTS ON TOTAL GROUP OF 28 CONSECUTIVE PATIENTS (IN AVERAGES)

Observation period average—2 years 4 months

	Av B.M.R. %	Av weight lb	Pat. pts with B.M.R. + or less
Initial	+31.5	136	94
Final	+4	145	73
Change	+37	9*	21
Within 3 months	+10	141	75
Within 1 year	+6	+145	73
*Gain 1 lb drop			

TABLE IV—RESULTS OF TREATMENT WITH RENT AND IODINE (HYMAN AND KFSSEL'S 50 PATIENTS) COMPARED WITH RESULTS FROM X RAY (28 PATIENTS THIS SERIES)

Percentage of patients whose B.M.R.s were +15% or less	Iodine series	X-ray series
Ag th not able administered	3	1
Within 3 months	15	11
Within 1 year	21	17
By end of 2 years	2	

TABLE VIII—PROTOCOL

	Case No	Sex	Age	Organic heart complication	*Initial			By 3 months			By 1 year			Last			Months seen since x ray
					BMR	Wt	Pulse	BMR	Wt	Pulse	BMR	Wt	Pulse	BMR	Wt	Pulse	
1	2608	M	50	2	+30	167	120	-6	173	60	-21	185	50	-12	192	78	36
2	1171	M	58	3 & 4	+60	146	91	+24	143	78	0	146	80	-10	149	70	32
3	1921	I	30	1	+31	142	92	+21	143	72	+2	143	80	-10	125	60	70
4	1570	M	60	3 & 4	+65	118	82	+18	120	78	0	133	70	0	128	58	60
5	2622	I	67	5	+19	136	108	+3	129	98	-3	134	72	0	112	80	40
6	1625	M	55	2	+17	131	78	0	155	56	+0	163	60	+0	163	60	36
7	2250	I	50	3	+11	132	96	-2	138	80	-8	114	68	-8	141	68	10
8	642	I	32	?	+47	89	124	+21	101	84	+1	106	70	-1	116	76	76
9	1556	I	48	1 & 2	+21	158	80	+11	161	80	+4	159	74	+4	159	74	11
10	2451	I	37	4	+18	186	76	+1	190	60	+18	173	68	-18	173	68	13
11	2636	I	71	3	+27	134	98	+20	132	90	-8	136	76	-8	136	76	10
12	1878	I	22	1	+37	95	96	-14	96	60	-14	96	60	-14	96	60	4
13	2265	I	39	NONI.	+21	150	94	-26	165	68	-26	165	68	-26	165	68	6
14	3310	M	62	2 & 3	+40	140	92	-4	128	82	+5	152	74	0	149	60	10
15	1655	M	65	2 & 3	+31	175	96	-8	184	62	-1	191	76	-1	191	76	11
16	1257	M	59	2 & 4	+70	128	110	+22	145	60	+17	155	51	-3	164	60	96
17	2653	I	49	1 & 2	+23	130	100	+6	125	70	+16	135	76	-16	135	76	10
18	780	I	47	6	+20	138	70	-13	148	76	-4	143	88	0	123	80	96
19	1850	I	53	3	+28	152	84	+17	149	80	+17	149	80	+17	149	80	3
20	1757	M	57	3	+43	170	91	+15	178	72	+15	178	72	+15	178	72	3
21	2070	I	57	2 & 3	+14	115	120	0	145	76	+34	155	96	+25	147	100	36
22	3855	M	32	NONI	+53	169	86	+45	170	90	+17	186	78	+13	180	84	28
23	3906	I	60	3	+32	124	86	+17	122	76	+11	123	86	+11	123	86	8
24	1578	I	49	2 & 4	+31	127	60	+16	127	52	+16	127	52	+16	127	52	6
25	1685	I	52	1	+60	110	101	+30	123	90	+30	130	84	+30	130	90	6
26	2436	I	72	2 & 4	+26	115	106	+33	115	90	+33	115	90	+33	115	90	2
27	2256	I	50	4	+22	116	96	+24	112	80	+24	112	80	+24	112	80	18
28	1521	I	41	1 & 2	+21	135	?	+14	138	?	+8	134	?	-4	135	?	48

*Organic heart complication (Key)

- 1 Rheumatic
- 2 Auricular fibrillation
- 3 Degenerative
- 4 Hypertension
- 5 Coronary occlusion
- 6 Lues

jectively or symptomatically, although she was able to return to teaching school for 1½ years, she then died of a stroke

Brief case reports will illustrate the type of result most generally attained

CASE 1 No 3340, male, 62 years of age, manager of a men's club, was referred to us by a surgeon on January 2, 1936. He complained of shortness of breath and palpitation on walking up slight grades, increased nervousness, and loss of weight of 13 pounds, all of which began during the preceding 4 months

Examination revealed a rather thin man whose skin was warm and moist. His eyes showed a slight lid lag and an arcus senilis was present. The thyroid gland was palpable but not enlarged. There was a moderate tremor, the pulse rate was 96, and the blood pressure was 160/75. The heart sounds were quite loud and a short systolic murmur accompanied the first sound at the apex. The ankles showed edema. X-ray showed a normal sized heart, but an electrocardiogram showed a flat T₁.

It was considered that the patient had degenerative heart disease and although a hyperthyroidism was suspected, it was not definitely diagnosed at this time

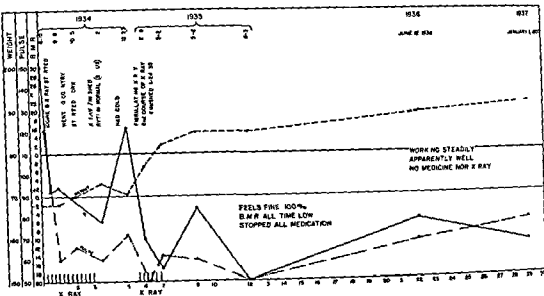


Fig 3 Weight pulse and metabolism record in Case 2

The results of the treatment in the entire group of patients as far as the objective data of basal metabolic rate, weight, and pulse rate are concerned are summarized in Table III. The data are purely objective and were recorded by the technician at the time the metabolism tests were taken.

We must bear in mind that we are dealing with a chronic illness which is subject to spontaneous remissions and in which such remissions are quite regularly produced by the administration of iodine. The improvement

which may be attained by rest, sedatives, and iodine alone is well shown by the 50 cases of hyperthyroidism reported by Hyman and Kessel in 1923 after having been followed for an average of about 2 years.

The improvement in their cases however is nowhere nearly as great nor as prompt as in the cases here reported in which x ray was also used. That it is the x ray that is chiefly responsible for the high percentage of cures is also evidenced by the fact that most of the series of cases reported in the literature were treated with x ray alone without any iodine (10, 11, 13).

In evaluating the results of therapy the entire group of 28 patients is subdivided artificially and arbitrarily into 3 headings: the *Cured*—similar to Case 1 (to be reported here) of which there were 17, or 60 per cent, the *Improved*—8 or 28 per cent and the *Failures* 3, or 12 per cent.

The objective data on the "cured" group are given in Table V.

Of the 3, or 11 per cent, failures 2 became a little better but stopped improving and were referred for surgery, after which one became cured and the other died five days after operation. The third never made what we considered satisfactory improvement either ob-

TABLE VII—RELATION OF HEIGHT OF INITIAL BASAL METABOLIC RATE TO FINAL RESULTS

Initial B.M.R.—%	Cases	Results
Pl 70		Cured
Plus 6 to 60	3	1 cured 1 improved
Plus 50 to 59	1	Improved
Plus 40 to 49	5	3 cured 2 improved
Plus 30 to 39	6	4 cured 2 unsatisfactory
Pl 20 to 29	9	4 cured 3 improved 2 failures
Plus 10 to 19	3	3 cured

N apparent relation between initial height of basal metabolic rate and degree of final improvement.

TABLE VIII—PROTOCOL

	Case No	Sex	Age	Organic heart complication	*Initial			By 3 months			By 1 year			Last			Months seen since x-ray
					BMR	Wt	Pulse	BMR	Wt	Pulse	BMR	Wt	Pulse	BMR	Wt	Pulse	
1	2698	M	50	2	+30	167	120	-6	173	60	-21	185	50	-12	192	78	36
2	1171	M	58	3 & 4	+60	146	94	+24	143	78	0	146	80	-10	149	70	32
3	1921	F	30	1	+31	142	92	+21	141	72	+2	143	80	-10	145	60	70
4	1570	M	60	3 & 4	+65	118	82	+18	120	78	0	133	70	0	138	58	60
5	2622	F	67	5	+19	136	108	+3	129	98	-3	134	72	0	142	80	40
6	1625	M	55	2	+47	134	78	0	155	56	+9	163	60	+9	163	60	36
7	2259	F	50	3	+14	132	96	-2	138	80	-8	144	68	-8	144	68	10
8	642	F	32	2	+47	89	124	+21	101	84	+1	106	70	-1	116	76	76
9	1556	F	48	1 & 2	+21	158	80	+11	161	80	+4	159	74	+4	159	74	11
10	2451	F	37	4	+18	186	76	+1	190	60	+18	173	68	-18	173	68	13
11	2636	F	71	3	+27	134	98	+20	132	90	-8	136	76	-8	136	76	10
12	1878	F	22	1	+37	95	96	-14	96	60	-14	96	60	-14	96	60	4
13	2165	F	39	NONE	+24	150	94	-26	165	68	-26	165	68	-26	165	68	6
14	3340	M	62	2 & 3	+40	140	92	-4	128	82	+5	152	74	0	149	60	19
15	3655	M	65	2 & 3	+31	175	96	-8	184	62	-4	191	76	-4	191	76	11
16	1257	M	59	2 & 4	+70	128	110	+22	145	60	+17	155	54	-3	164	60	96
17	2653	F	49	1 & 2	+23	130	100	+6	125	70	+16	135	76	-16	135	76	10
18	780	F	47	6	+20	138	70	-13	148	76	-4	143	88	0	123	80	96
19	1850	F	53	3	+28	152	84	+17	149	80	+17	149	80	+17	149	80	3
20	1757	M	57	3	+43	170	94	+15	178	72	+15	178	72	+15	178	72	3
21	2070	F	57	2 & 3	+44	145	120	0	145	76	+34	155	96	+25	147	100	36
22	3855	M	32	NONE	+53	169	86	+45	170	90	+17	186	78	+13	180	84	28
23	3996	F	60	3	+32	124	86	+17	122	76	+11	123	86	+11	123	86	8
24	1578	F	49	2 & 4	+31	127	60	+16	127	52	+16	127	52	+16	127	52	6
25	1685	F	52	1	+60	110	104	+30	123	90	+30	130	84	+30	130	90	6
26	2436	F	72	2 & 4	+26	115	106	+33	115	90	+33	115	90	+33	115	90	2
27	2256	F	50	4	+22	116	96	+24	112	80	+24	112	80	+24	112	80	18
28	1521	F	41	1 & 2	+21	135	?	+14	138	?	+8	134	?	-4	135	?	48

*Organic heart complication (Key)

- 1 Rheumatic
- 2 Atrial fibrillation
- 3 Degenerative
- 4 Hypertension
- 5 Coronary occlusion
- 6 Lues

jectively or symptomatically, although she was able to return to teaching school for 1½ years, she then died of a stroke

Brief case reports will illustrate the type of result most generally attained

CASE 1 No 3340, male, 62 years of age, manager of a men's club, was referred to us by a surgeon on January 2, 1936. He complained of shortness of breath and palpitation on walking up slight grades, increased nervousness, and loss of weight of 13 pounds, all of which began during the preceding 4 months

Examination revealed a rather thin man whose skin was warm and moist. His eyes showed a slight lid lag and an arcus senilis was present. The thyroid gland was palpable but not enlarged. There was a moderate tremor, the pulse rate was 96, and the blood pressure was 160/75. The heart sounds were quite loud and a short systolic murmur accompanied the first sound at the apex. The ankles showed edema. X-ray showed a normal sized heart, but an electrocardiogram showed a flat T₁.

It was considered that the patient had degenerative heart disease and although a hyperthyroidism was suspected, it was not definitely diagnosed at this time

In spite of bed rest, digitalis and restriction of salt and fluid intake edema progressed, nervousness became more marked, paroxysms of auricular fibrillation ensued and the patient's weight dropped. After a month of a downhill course a basal metabolic test was taken which showed a rate of $+40$ per cent. The patient was immediately given Lugol's solution 10 drops three times a day, and started on x ray treatment to the thyroid. He was able to get to the radiologist only with difficulty because of weakness. For the first 4 weeks of treatment with iodine and x ray he continued to get worse and on March 16 1936 his weight had dropped to 126 pounds, his basal pulse was 100 and his basal metabolic rate was still $+23$ per cent.

By March 23, 1936, he had had 10 x ray treatments was feeling a little better and his basal metabolic rate had come down to $+9$ per cent. However his weight was only 125 pounds in spite of the fact that he was still edematous, his pulse rate was 94 and he was having paroxysms of auricular fibrillation two or three times a day.

From this point 6 weeks after x ray treatment was started he improved rapidly. A month later edema had disappeared the pulse was down to 80 and he started going back to his office part time. By July 1 1936 just 6 months from the beginning of treatment he stated that he felt particularly well was working regularly his pulse was 60, and it was necessary for him to diet to keep his weight within bounds, which state of well being he has kept to the present date.

CASE 2 No 2698 male 52 years of age a clerical worker was first seen at his home August 15 1934 a little over 3 years ago.

He was complaining of weakness palpitation nervousness, and loss of weight from about 200 pounds to 170 pounds, all during the preceding month although he had not been feeling quite well for 2 or 3 months before that.

When seen, he was lying in bed very restless fidgety, and constantly sticking his feet out from under the covers drawing them in turning over etc. He looked as though he had lost some weight and was quite tremulous. His heart rate was 130 and absolutely irregular. The heart sounds were clear and the blood pressure was 120/70. The electrocardiogram showed auricular fibrillation but no other abnormality. He had had a similar but milder attack some 10 years before.

It appeared obvious that the man was suffering from hyperthyroidism with auricular fibrillation. He was sent down on the next morning for a basal metabolism test which showed a rate of $+30$. An electrocardiogram showed auricular fibrillation. X ray examination showed no enlargement of the heart. He was immediately placed upon Lugol's solution and started on x ray treatments to the thyroid.

He had been taking 40 drops of digitalis twice a day for the preceding month in spite of which his heart rate was still 130. He was continued on 2

grains of digitalis leaf twice a day about the same dose as he had been taking of the tincture. By September 8 1934 a little over 3 weeks from starting treatment his basal metabolic rate was $+1$ per cent and his pulse rate down to 60 although still absolutely irregular. He had not gained any weight but was feeling well enough so that he was allowed to go away to the country for a couple of weeks.

One month later he came back stating that he felt fine could walk 1 or 2 miles without any trouble and had gained 3 pounds. His basal metabolic rate at this time was $+4$ per cent. He started to work part time October 5 1934 about 6 weeks from the onset of his treatment and has worked uninterrupted ever since.

He was given about 6 more x ray treatments making a total of 12. On a few doses of quinine his pulse became regular and has remained so to date.

RESULTS AND CONCLUSIONS

While we are not presenting the x ray and iodine therapy of hyperthyroidism as the only, or even under all circumstances as necessarily the best form of treatment, we feel that it has the following to recommend it:

- 1 It will result in 60 per cent cures as evidenced by (a) disappearance of the symptoms of hyperthyroidism, (b) economic restitution, (c) basal metabolic rate of plus 10 per cent or below, (d) basal pulse rate of 80 or below, (e) gain of weight to near former average.

- 2 In another 28 per cent it will afford marked improvement.

- 3 Thus, in well over 80 per cent the results are satisfactory.

- 4 There is no direct mortality nor complication to the treatment.

- 5 The patients are usually ambulatory and often continue working during treatment.

- 6 It is speedy, definite improvement often occurs by 6 weeks and usually by 3 months.

- 7 If it fails after a reasonable trial surgery can be employed.

- 8 It can, at times, be applied to patients who for economic or psychological reasons refuse to consider surgery.

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SURGICAL JAUNDICE—DIAGNOSTIC CONSIDERATIONS

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IN recent years the term "surgical jaundice" has been used extensively to denote a condition which is characterized primarily by marked jaundice, associated with more or less secondary signs and symptoms of variable importance, and which demands operative interference for its satisfactory, whether curative or palliative, termination. Despite its rather frequent occurrence and the awareness of the medical profession that such a condition exists, it has not been given the important consideration that it merits. Thus we often see patients with jaundice who are being observed under conservative management for weeks and weeks, simply for changes in the intensity of the icterus, notwithstanding the fact that the depth of the jaundice *per se* is in the majority of the cases of little importance in the diagnosis and differential diagnosis of the existing pathology.¹ This "watchful waiting" policy is applied especially in cases in which there is no pain, palpable mass, or gall stone shadows in the roentgenogram, as in these cases the lack of such findings brings with it a false sense of security.

Jaundiced patients as a group receive less attention on the part of the medical profession than they justly deserve. The indifferent attitude of clinicians is found especially to ward those jaundiced patients who on examination, fail to suggest the possibility of a stone in the common duct as the cause of jaundice. This attitude seems to be attributable to the assumption that if an icterus is not of the calculous or catarrhal type, it is usually fatal. Cases of jaundice therefore not belonging to these two types were considered hopeless and treated as such.

It must be admitted that, diagnostically and therapeutically icterus presents a serious

problem, and that, hence, observation of the patient is important. We wish however, to stress the fact that this observation should be combined with (a) an intensive study of the patient (b) search for the cause of the discoloration and (c) prompt treatment thereof. Recent statistics and reports from various clinics as also our own experience, tend to dispel the gloomy outlook once prevalent in regard to icteric patients. With the introduction of intensive dextrose therapy, multiple pre-operative and postoperative blood transfusions, and attention to the patient's vitamins, fluid, and salt requirements, the results of therapy in surgical jaundice have improved considerably. This improvement to be sure, has been aided not only by better preparations but also by more discriminate selection of patients for surgery—selection referring to better work up.

It is not within the scope of this paper to go into a lengthy discussion of the differential diagnosis of jaundice. Here we intend to discuss mostly the positive factors pointing to a surgical jaundice. We will also discuss some of the outstanding characteristics encountered in our cases of icterus both at the Cook County Hospital and in private practice, the recognition of which has given us a higher percentage of correct diagnoses and thus better managed patients.

When confronted with a jaundiced patient one must realize that 60 per cent or more of icteric cases fall in the so called surgical jaundice group. According to recent statistics by Snell cholelithiasis and associated conditions are responsible for 25 per cent of jaundice, carcinoma, both metastatic and primary in the head of the pancreas, gall bladder or bile ducts for 30 per cent, and benign strictures of the common duct for up to 10 per cent. Similar figures were obtained in our own series in which 32 per cent of the cases were considered malignant and 26 per cent benign. Furthermore obstructive jaundice requiring surgical interference occurs more often in

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¹The icterus may actually drop in the presence of a per cent obstruction if less bilirubin is formed.

middle or later life than in younger individuals. Hence, a jaundiced, middle aged patient has 65 to 70 per cent chance to have an obstructive type of icterus. If this patient is a woman, the cause of obstruction is considered to be a calculus, though this did not hold for our series. If the patient is a man, the cause is more often a malignancy, usually of the digestive apparatus. A history of previous biliary tract disease or biliary colic obviously points toward a calculous obstruction. At times, however, it suggests a carcinoma of the gall bladder. A previous operation on the gall bladder should make one consider the possibility of a benign stricture of the common duct. It is hardly necessary to mention that a history of exposure to hepatotoxic substance or a history of any systemic disease, should make the patient a case of hepatitis¹ until unmistakable evidence of obstruction is obtained. It is to be kept in mind that, occasionally, even in cases with a history such as this a primary, obstructive factor may be the cause of the icterus. In such cases, errors are not uncommon, and appropriate treatment is often started too late.

The two main elements in jaundiced patients which may be said to point toward an obstructive factor that might be removed by surgery, are an enlarged, palpable gall bladder and a history of biliary colic. Unfortunately, these two features may be absent in as high as 40 per cent and 25 per cent of the cases, respectively, a fact which is not generally appreciated. In our series the most painless case of icterus was present in a man who had had an obstruction of the common duct due to an impacted stone, while in 34 cases of common duct obstruction due to malignancy the gall bladder was palpable in only 4 instances, although found enlarged at operation in 11 cases. It is obvious, then, that the diagnosis of a surgical jaundice cannot rest on any single criterion, but on a correct evaluation of a number of presenting factors.

The data, offered in this communication, are based on a study of 105 cases of jaundice, of which 62 were diagnosed as surgical jaundice and will be discussed later. Of these 62 cases, 34, or 54.8 per cent, were due to malig-

nant, and 28, or 45.2 per cent, to benign (1 e. calculous or strictural) obstruction. The diagnosis of surgical jaundice was based on the history, physical examination and laboratory tests, and was confirmed by surgery or necropsy in 28 of the 34 malignant patients (82.3 per cent), and in 13 of the 28 benign cases (46.4 per cent). In 4 cases the diagnosis of malignant obstruction was proved to be erroneous, as a complete benign obstruction due to a calculus was found on operation. No case of icterus due to malignant obstruction was diagnosed as benign, possibly because in so called silent jaundice one is inclined toward the diagnosis of a malignancy.

Of the 34 cases of icterus due to malignancy, 22 were male (64.7 per cent), and 12 female (35.3 per cent); while of the 28 benign cases, 18 were male (64.3 per cent), and 10 female (35.7 per cent). It is apparent that males predominate in both the malignant and the benign groups.

The ages of the patients in the malignant group varied from 34 to 79, with an average age of 55.5 years. In the benign group the youngest patient was 26 years old, and the oldest 71 years; the average age being 48. We believe that the comparatively high average age in the benign group is most likely due to two factors. First, the majority of the patients are men, in whom gall bladder disease is less often thought of, second, all patients, regardless of sex, ignored the milder symptoms and did not come under medical attention until marked jaundice had developed.

The duration of definite symptoms prior to the patient's entrance into the hospital was, on the average, less than 1 year in the malignant and about 3 years in the benign group. Symptoms of dyspepsia before the concrete symptoms had begun were usually present for but a short time in the malignant, but for years in the benign group. It is noteworthy that in 1 case of gall bladder carcinoma (not included in this series) there was a history of cholelithiasis of 40 years' duration.

Of the 34 malignant cases, 8 (23.5 per cent) had a history of sharp pain in the right upper quadrant, 12 (35.3 per cent) had dull, upper abdominal distress, 6 (17.8 per cent) had vague abdominal discomfort, and 8 (23.5 per

¹Extensive degeneration of liver parenchyma

cent) had no pain. Among the latter there were patients with carcinoma of the stomach, pancreas, gall bladder, ovary, common and hepatic ducts. In the benign group, however, 14 (50 per cent) had a history of severe, colic like pain, 11 (39.3 per cent) had upper abdominal distress and 3 (10.7 per cent) had no pain. It should be emphasized that while 8 patients of the malignant group had a colic like pain, none of them required morphine for its relief, in contrast to the colics experienced by the patients of the benign group, of whom more than half required morphine for the relief of pain. Diet, medications, local heat and rest were reported as some relief producing measures by both groups.

Loss of weight was present in 22 malignant (64.7 per cent) and in 5 benign (18.0 per cent) cases. This symptom therefore, appears to be an important factor in the diagnosis of jaundice.

Marked pruritus was complained of by 14 (41 per cent) patients of the malignant, and by 6 (21.4 per cent) of the benign group. This finding is in agreement with the clinical impression that pruritus is a more common symptom in the complete obstructive type of jaundice.

A history of sepsis (chills, fever and sweats) was given by 1 patient (3.0 per cent) in the malignant, and 9 (32 per cent) patients in the benign group. While in the hospital, however, about an equal percentage of both groups ran a low grade fever.

An alcoholic history was obtained in 9 malignant (26.4 per cent) and 8 benign (28.4 per cent) cases. The Kahn reaction was positive in 2 of the malignant (6 per cent) and 4 of the benign (14.2 per cent) group.

Nausea and vomiting were present in almost equal proportions among the patients of the two groups. Constipation or diarrhea as a symptom was present in too few cases to be of any diagnostic significance.

Almost all patients noted changes in the color of the urine and the stool, and some of them reported intermittent changes in the color of their excreta.

None of the patients in this series gave a history of exposure to hepatotoxic substances. Three were diabetic and 2 gave a

history of a "cold" having been present at the onset of their illness.

Considering the data obtained on physical examination, it may be stated that as a whole the patients in the malignant group appeared more critically ill, frequently wasted, and somewhat apathetic. Those of the benign group were better nourished, alert and complained loudly, even though quite ill and septic at times.

Without going into the theoretical considerations of the causes of the greenish discoloration in obstructive jaundice as given by Franke, we can confirm the observations by Snell et al. that, in the occlusion of the biliary system, especially if it be on a malignant basis, the patient presents a peculiar greenish yellow skin color which in cases of long duration turns to an almost bronze color. This discoloration is quite striking in comparison with the reddish jaundice of hepatosis. It is frequently associated with a severe pruritus and factitious dermatitis. In the patients of the benign group, unless there is a rarely encountered complete obstruction, this greenish hue is not a striking feature.

It may not be amiss to remark that the jaundiced patient requires a thorough physical examination which should include a search for possible lymph node metastases, scars from previous operations, masses in the abdomen, rectum, pelvis, etc. and a determination of the size of the liver, spleen, gall bladder, and kidney. In our cases the liver was enlarged to different degrees in 18 cases (82.3 per cent) of the malignant and in 19 (68 per cent) of the benign cases. The gall bladder was palpable in 4 (11 per cent) and 3 (10.7 per cent) cases respectively. No spleen was felt. Tenderness in the right upper quadrant was present in about an equal number of cases in both groups.

The following important data were obtained from laboratory examinations:

Acholic stools on consecutive daily examination were present in 16 (76.4 per cent) of the malignant and in 2 (7 per cent) of the benign cases. In all these cases no urobilin was found in the urine. Daily variations as to the presence of urobilin in the stool and urine were noted in 4 malignant (11 per cent)

and 3 (10.7 per cent) benign cases. The remainder of the benign cases showed some bile in the stool and urobilin in the urine on almost all examinations. Hence in cases that *give persistent negative urobilin tests in the stool and urine for from 10 to 14 consecutive days, the diagnosis of a surgical jaundice of the malignant type is strongly suggested*.

The Van den Bergh reaction was direct in 15 of 18 malignant cases (83 per cent) in which the test was done, and biphasic in the other 3 cases. It was direct in only 4 (21 per cent), and biphasic in 15 benign cases. No indirect reaction was obtained in this series.

The height of the icterus was measured by the Meulengracht method at intervals of from 2 to 4 days. Corresponding with observations by others, the icterus intensity was found at a high and slowly mounting level in the malignant and of variable intensity in the benign cases. From reports in the literature and from our own observation we infer that a slight drop in the icterus does not mean that no obstruction is present or that the obstruction has been relieved. The icterus index was above 100 in 25 (75.5 per cent) of the malignant and in only 6 (21.4 per cent) of the benign cases. It was rising in 12 (35.3 per cent) malignant and in only 1 (3.5 per cent) benign case.

The plasma cholesterol was above 200 milligrams per 100 cubic centimeters in 18 (53 per cent) malignant and 14 (50 per cent) benign cases. Below 200 (170-200) in 10 (30 per cent) and 8 (25 per cent), respectively. Lower values were obtained in cases of hepatitis-jaundice. Determinations of cholesterol esters were not performed in this study.

Too few phosphatase and serum albumin-globulin ratio determinations were performed in these groups. Hence their importance cannot be discussed at this time.

The galactose tolerance test was applied in 13 malignant and 15 benign cases. Less than 3 grams of galactose was excreted by 12 malignant (92.3 per cent) and 12 benign cases (80 per cent). Above 3 grams was found in 1 of the malignant and 3 benign cases.

A modified dextrose-tolerance test (3) was done in 26 cases of the malignant and in 24

of the benign group. An ascending curve pointing to a complete obstruction was obtained in 19 (73 per cent) of the 26 malignant and in 6 (25 per cent) of the 24 benign cases. A slowly dropping curve, supposedly characteristic of incomplete obstruction, was obtained in 7 (27 per cent) malignant and 18 (75 per cent) benign cases. Further study on a larger series of cases will be necessary before an evaluation of this test can be made, although in our investigation it has proved quite reliable.

Cholecystograms were attempted in 18 malignant and 20 benign cases. Non-visualization of the gall bladder was reported in 16 and 17 cases, respectively, although on operation the gall bladder was found enlarged in 11 malignant and 2 of the benign cases. In 2 patients with carcinoma of the pancreas, faint visualization of the gall bladder was reported. Since, however, in both these cases the viscus was greatly distended and palpable, it may be logical to assume that the faint visualization might have been independent of the dye ingestion. We have reason to believe that in the presence of jaundice the liver does not excrete the dye used in the Graham-Cole test, and that this test, at least as done at present, is almost useless.¹ This opinion is based on some experimental findings by one of us (F. S. 5), and is in accordance with the findings of numerous other workers in this field.

Ordinary roentgenograms of the region of the gall bladder were taken all together in 27 cases, and in none of these have we found shadows suggestive of gall stones. Still, on operation, stones were found in 8 instances. A negative flat plate of the abdomen, is, therefore, of no diagnostic importance, as it does not exclude the possibility of cholelithiasis. X-ray examination of the gastrointestinal tract is useful in cases in which a malignancy in this system may cause an obstructive jaundice through compression of the common duct by periportal metastases.

A leucocytosis was found in about equal proportions in both groups and did not seem to be of any diagnostic significance.

¹It is possible that the method recently described by Foote, et al., will be of more value.

FACTORS IN DIAGNOSIS AND TREATMENT

We have attempted to discuss the factors presented in the history, physical examination, and laboratory examination, which were found useful in the making of a diagnosis in cases of surgical jaundice. It is believed that attention to some of the features recorded will prove of aid in diagnosing such a condition. *Although we believe that a clinical impression derived from a well taken history and physical examination is of inestimable value in a case of jaundice, nevertheless we are of the opinion that in such cases the laboratory work up is of no little importance.* In fact, it is in some of these cases of icterus that the laboratory data find their most useful diagnostic reward. To be sure the tests must be done accurately. They must be evaluated correctly. They must not be taken as pathognomonic signs. It is in the evaluation of all the data obtained that one's clinical judgment is of importance. It is the clinical judgment that tells one that no single test measures the complex functions of the liver, that no single type of icterus is the sole problem in any case, unless it is shortly after the onset, and that, *when seen by the doctor, the patient with an icterus of some standing is a complicated problem in which one or the other type of jaundice is only predominant.*

Surgery appears to be indicated in jaundiced patients, who present themselves with an icterus of variable or increasing intensity especially if associated with a greenish hue, pruritus and dermatitis, who give a history suggestive of a previous biliary or gastrointestinal tract disease, who are in late middle life or older, and who have had no exposure to hepatotoxic substances or a systemic disease. This indication is especially clear when these patients show an enlarged liver palpable gall bladder other palpable abdominal masses palpable lymph glands loss of weight and absence of a palpable spleen. The ultimate proof for surgery is obtained by finding acholic or variably colored stools for 10 to 14 days consecutively, bilirubinuria but no urobilinuria for the same length of time, a direct or biphasic Van den Bergh reaction, a moderate to high icterus index stationary or ascending, a high plasma

cholesterol, a low galactose excretion an ascending or only slightly descending dextrose tolerance curve, and a visualization of gall stones. Given all, or most, of these data we do not hesitate to advise surgical relief of the jaundice after a careful pre operative preparation of the patient.

Since none of us is infallible and most cases cannot be said to be typical we may occasionally diagnose a surgical jaundice in patients who fail on exploration to show any obstruction to the outflow of the bile. We believe that even such cases are benefited by the operation and drainage of the biliary tract, as it must be kept in mind that jaundice from any cause, persisting for any length of time, is productive of definite pathology in the liver and bile ducts. Measures for relief of this condition are therefore best instituted as early as possible. We have recently observed several cases of long standing jaundice in which on operation no cause for the obstruction was found but who had a rather remarkable change for the better soon after drainage of the common duct had been brought about. The exact causes for these occlusion icterus types is not definitely known, although in 2 of our cases stones were found in the gall bladder, in 1 the pancreas felt indurated and edematous, and in 1 there was a diffuse thickening around the common duct but no encroachment on the duct. Hence the possibility of stones in the gall bladder solely, pancreatitis or edema of the pancreas and surrounding tissues or spasm of the sphincter of Oddi as causes of jaundice have to be considered. Fortunately, then, the conditions with which the biliary affection in the presence of jaundice may be confused constitute in themselves definite indications for surgical procedure.

The importance of early recognition of surgical jaundice is demonstrated by the fact that many patients who have biliary colic and intermittent attacks of slight icterus go on to a severe liver damage if relief is not obtained through surgery. This may explain why male cases predominate in an almost 2 to 1 ratio in cases of calculous jaundice in spite of the normal predominance of women over men in cholecystitis and cholelithiasis. It seems that

cholelithiasis is usually a late diagnosis in men. That these cholelithiasis cases of long standing have a hepatitis is manifested from the findings on operation when 5 of 15 cases (38 per cent) showed unmistakable liver damage. The liver involvement in these cases may be perceived also from the galactose excretion and descending dextrose-tolerance curve. Finally, the overlooking of a benign surgical jaundice on a calculous basis may lead later to a more marked and malignant type of jaundice due to a carcinoma of the gall bladder.

SUMMARY

1 Sixty-two cases of surgical jaundice, of which 41, or 66 per cent, were confirmed by operation, necropsy, or both, are discussed from the diagnostic point of view.

2 The frequency of the more important findings in the history, physical examination, and laboratory work-up which point toward a surgical jaundice, is indicated.

3 Stress is laid on the necessity of intensive study of the patient so as to arrive within a reasonable time at a working diagnosis, on the fact that no sign, symptom, or test is pathognomonic, but that intelligent interpretation of all the data should be the basis of clinical judgment.

4 The series has been subdivided into a malignant and non-malignant group, mainly for the purpose of focusing attention on the greater manifestation of the various features of

TABLE I—SIGNIFICANT DIFFERENTIAL DIAGNOSTIC FACTORS IN OBSTRUCTIVE TYPES OF ICTERUS

(As elicited in a study of sixty-two surgical jaundice cases)

	Finding	Malignant group per cent	Non-malignant group per cent
1	General attitude	Rather apathetic	Alert and complaining
2	Pruritus	41	21
3	Enlarged liver	82	68
4	Icterus	Slowly mounting on high level	Variable
5	Icterus above 100	75	21
6	History of sepsis	3	32
7	Loss of weight	65	18
8	No urobilin in urine	76	7
9	Acholic stools	76	7
10	Direct Van den Bergh	83	21
11	Low galactose excretion	92	80
12	Ascending glucose curve	73	25
13	Morphine required for pain	0	50

surgical jaundice in the malignant group in which the obstruction is usually more definite and more complete (Table I).

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FACTORS IN DIAGNOSIS AND TREATMENT

We have attempted to discuss the factors presented in the history, physical examination, and laboratory examination, which were found useful in the making of a diagnosis in cases of surgical jaundice. It is believed that attention to some of the features recorded will prove of aid in diagnosing such a condition. Although we believe that a clinical impression derived from a well taken history and physical examination is of inestimable value in a case of jaundice, nevertheless we are of the opinion that in such cases the laboratory work up is of no little importance. In fact it is in some of these cases of icterus that the laboratory data find their most useful diagnostic reward. To be sure the tests must be done accurately. They must be evaluated correctly. They must not be taken as pathognomonic signs. It is in the evaluation of all the data obtained that one's clinical judgment is of importance. It is the clinical judgment that tells one that no single test measures the complex functions of the liver, that no single type of icterus is the sole problem in any case unless it is shortly after the onset and that, when seen by the doctor, the patient with an icterus of some standing is a complicated problem in which one or the other type of jaundice is only predominant.

Surgery appears to be indicated in jaundiced patients, who present themselves with an icterus of variable or increasing intensity, especially if associated with a greenish hue, pruritus, and dermatitis, who give a history suggestive of a previous biliary or gastrointestinal tract disease, who are in late middle life or older, and who have had no exposure to hepatotoxic substances or a systemic disease. This indication is especially clear when these patients show an enlarged liver palpable gall bladder other palpable abdominal masses, palpable lymph glands, loss of weight, and absence of a palpable spleen. The ultimate proof for surgery is obtained by finding acholic or variably colored stools for 10 to 14 days consecutively, bilirubinuria but no urobilinuria for the same length of time, a direct or biphasic Van den Bergh reaction, a moderate to high icterus index, stationary or ascending a high plasma

cholesterol, a low galactose excretion, an ascending or only slightly descending dextrose tolerance curve, and a visualization of gall stones. Given all, or most of these data, we do not hesitate to advise surgical relief of the jaundice after a careful pre operative preparation of the patient.

Since none of us is infallible and most cases cannot be said to be typical, we may occasionally diagnose a surgical jaundice in patients who fail on exploration to show any obstruction to the outflow of the bile. We believe that even such cases are benefited by the operation and drainage of the biliary tract, as it must be kept in mind that jaundice from any cause, persisting for any length of time, is productive of definite pathology in the liver and bile ducts. Measures for relief of this condition are therefore best instituted as early as possible. We have recently observed several cases of long standing jaundice in which on operation no cause for the obstruction was found, but who had a rather remarkable change for the better soon after drainage of the common duct had been brought about. The exact causes for these *occlusion icterus* types is not definitely known, although in 2 of our cases stones were found in the gall bladder, in 1 the pancreas felt indurated and edematous, and in 1 there was a diffuse thickening around the common duct but no encroachment on the duct. Hence the possibility of stones in the gall bladder solely, pancreatitis or edema of the pancreas and surrounding tissues or spasm of the sphincter of Oddi as causes of jaundice have to be considered. Fortunately then the conditions with which the biliary affection in the presence of jaundice may be confused constitute in themselves definite indications for surgical procedure.

The importance of early recognition of surgical jaundice is demonstrated by the fact that many patients who have biliary colic and intermittent attacks of slight icterus go on to a severe liver damage if relief is not obtained through surgery. This may explain why male cases predominate in an almost 2 to 1 ratio in cases of calculous jaundice in spite of the normal predominance of women over men in cholecystitis and cholelithiasis. It seems that

termed a "biological conception" since it has resulted from research in this science. Although widely accepted among biologists, its significance with regard to hermaphroditism in man has received scant recognition because of either neglect or misinterpretation.

This theory is based upon recent studies of intersexuality in animals which were initiated by Lilly's investigations of heterosexuality in cattle. These findings are described and discussed by Willier in *Sex and Internal Secretions* edited by Edgar Allen. The essential features of this theory may be summarized as follows:

1 The primary gonads are identical in both sexes but they are not bisexual at any stage, they are always testicular in nature and capable of direct development only into testes and not into ovaries.

2 In males the testes arise directly from them but in females the cortical ovarian tissue grows around them and they thus become reduced to an inactive or vestigial state in the medulla.

3 Femaleness is, therefore, at least potentially bisexual because of the possible presence of testis tissue remains in the medulla of the ovary but maleness is necessarily unisexual by reason of the absence of tissue homologous with that of the cortex of the ovary.

The data with regard to the clinical features of hermaphroditism have been collected from 67 reported cases in which the descriptions were adequate for the purpose. Cases associated with extra-gonadal tissue lesions, such as adrenal tumors, were not included.

The material has been divided into 4 groups: (1) male pseudohermaphroditism without muellerian derivatives, 12 cases, (2) female pseudohermaphroditism, 15 cases, (3) true hermaphroditism, 17 cases, (4) male pseudohermaphroditism with muellerian derivatives, 23 cases. The references for each group are enumerated in the bibliography.

The following manifestations of these cases have been tabulated, the situation and nature of the gonads, the derivatives of the muellerian and wolffian ducts and of the urogenital sinus, the prostate, inguinal hernia, and, in adults, the body configuration, the breasts, and the

beard. Following Koff, quoted by Young, the anterior portion of the vagina has been considered a derivative of the urogenital sinus. The terms "male body" and "female body" are used for convenience to denote the relative width of the shoulders, waist, and hips as they usually occur in normal men and women. Findings with reference to the larynx, voice and distribution of the suprapubic hair were omitted as these often were not recorded. In order to keep the tabulations within reasonable limits it was necessary to avoid meticulous descriptions of variations of the essential features.

Group 1 Male pseudohermaphroditism without muellerian derivatives. In this group there were 12 cases—11 white and 1 Arab.

The ages varied as follows: 3 were 12 to 14 years, 7 were 17 to 25 years, 1 was 34 years, 1 was 49 years. One was considered male and 11 female.

In 2 cases there was only 1 testis, this was in the abdomen beneath the peritoneum in 1 and in the groin in the other. In 8 the testes were in the groins, in 1 in a cleft scrotum and in the labia in 2. Microscopic sections were examined in 11 and all showed atrophic testis tissue.

There were no muellerian derivatives.

As to wolffian derivatives, in 4, there were present epididymis and vas, in 1, an epididymis, in 2, no epididymis or vas, in 5, no mention is made.

The urogenital sinus derivatives are mentioned as follows: phallus in 3, described as small or normal clitoris, large clitoris or small penis in 9, urethra hypospadiac in 12, cleft scrotum and vagina in 1, vagina and labia in 3, rudimentary vagina (2, labia small and 1, labia resembled scrotum) in 7, small labia without vagina in 1.

Cystoscopy was done in 2 and no structures normally found in the prostatic urethra were seen. A prostate was mentioned in 2. In 2 it was said that a prostate was not demonstrable.

Inguinal hernia was present in 5 and the gonads were outside the sac in all.

As to adult findings, in the 9 cases aged 17 to 49 years: 7 presented a male body, the breasts were flat in 6 and slightly developed in 1, the beard was heavy in 2, scant in 1, and absent in 4.

One presented a female body with breasts developed but no beard. One was described as female in all respects. One was a wife.

There is no dispute with regard to the sex of the individuals of this group, it is universally agreed that they are male.

Testis hormone inadequacy at the early fetal stage of development of the wolffian ducts is apparent, in certain cases, from the

A NEW CONCEPTION OF HERMAPHRODITISM

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HERMAPHRODITISM may be defined as a condition of intersexuality of fetal origin. Two main divisions, true and false, are currently described. The distinguishing feature of true hermaphroditism is the mixed sex construction of the gonads as shown by such combinations as a testis on one side and an ovary on the other or an ovotestis on either or both sides. In pseudohermaphroditism the gonads are said to be unisexual. Therefore, two subdivisions are recognized. In the male form testes are present in individuals who have certain female characteristics, in the female form ovaries are present in persons with certain male characteristics.

This classification is based upon the prevailing theory of the embryology of the sex glands and their dependent structures which may be summarized as follows:

1. The gonadal anlagen are identical in both sexes and are either actually or potentially bisexual. By this is meant that these original embryonic masses are composed of cells which may give origin directly to either testes or ovaries and are therefore capable of elaborating both distinctive sex hormones or that they are sexually indifferent but capable of later differentiation into either testes or ovaries.

2. If ovaries develop, the müllerian ducts will be stimulated to proceed to the formation of female organs of generation and the wolffian system will be suppressed. If testes develop, the wolffian ducts will proceed to the formation of testicular appendages and the müllerian system will be suppressed.

According to this theory sex is denoted solely by the nature of the gonads. However, because of the alleged bisexual origin of both ovaries and testes, neither sex is thought to be a condition of absolute unisexuality; both normally are said to represent only a state of

predominant influence of their distinctive sex glands. Hence it is often stated that "there is a little bit of femaleness in every male and a little maleness in every female."

True hermaphroditism is asserted to exemplify plainly this dual nature of the gonads. The simultaneous occurrence of testicular and ovarian tissues is attributed to the fact that the original embryonic mass, instead of proceeding along one of two possible courses, has developed along both. For this reason, therapeutic efforts are directed toward the restoration of the accessory structures normally associated with the type of sex gland which is judged to be predominant.

Hermaphroditic manifestations in persons with unisexual sex glands—pseudohermaphrodites—are partly explained on the grounds of gonadal hormone dysfunction. Therapeutic measures used in cases of this kind have as their objective restoration of the sexual apparatus to conform with the type of sex gland present.

Although generally accepted, this theory affords an unsatisfactory foundation for the clinical approach to the problems of hermaphroditism because the theoretical considerations are not in accord with the clinical findings.

It is particularly important that the therapy of these abnormalities should be based upon proper understanding of the fundamental factors involved, since this concerns not only those so afflicted but others with whom marriage may be contracted and also the community at large in cases presenting sexual behavior problems.

The existing incongruities between theory and actualities have prompted this investigation of the manifestations of the various forms of hermaphroditism with particular respect to the interpretation of their embryological sources. The subject will also be considered with relation to another theory of the embryology of the sex glands which may be

indicates that there was no abnormal sex influence at the stage of development of this gland

That the male influence arose at a slightly later stage of fetal life is shown by the frequent abnormalities of the structures derived from the urogenital sinus

This not only resulted in frequent male-like formations of the external genitalia, varying from the presence of a scrotum and penile urethra to a scrotum-like appearance of the labia, but also caused distortion of the normal construction of the deeper portion of the vagina. The resulting developmental consequences, such as failure of normal fusion of the two parts of the vagina and establishment of a communication between the urethra and posterior vaginal pouch, are of significance in connection with the question of the true sex in the following groups

Continuance of the male influence from this point is shown by the adult findings. The incidence, in this group, of such stigmas of virilism as amenorrhea, masculine body configuration, atrophy of the breasts, and hirsutism, is greater than in the group of true hermaphroditism

The abnormalities in these cases of female pseudohermaphroditism are clearly attributable to the presence of the opposite sex hormone, and to this extent there is no fundamental difference between this condition and true hermaphroditism

The nature of the lesion responsible for these changes is not known, but there is every reason to believe that it is related to the bisexual origin of the ovary. It might appear safe to assume that it is extra-ovarian because of the fact that in the 6 cases in which sections were examined, normal ovarian tissue was found. However, these sections were evidently taken from the cortex

Kohn, and later Berger, reported the presence in normal ovaries of cells resembling testis interstitial cells which were located in the hilus and usually in the lateral portion. Ramsay and McCahey recently found similar cells in the hilar area of normal ovaries, in the majority of specimens these were situated laterally and sometimes extended into the adjacent portion of the mesovarium. A

structure apparently identical with embryonal testis cords was found in the same area of an ovary from a case of virilism. On the basis of these findings, McCahey and Ramsay suggested further study of this portion of the ovary in conditions of masculinization, including female pseudohermaphroditism, for the presence of testis tissue elements with a view to the possible benefits of ablation of the lateral portion of the ovaries and adjacent parts of the mesovarium

Group 3 True hermaphroditism In this group were 17 cases 14 white, 3 colored

The age incidence was as follows 1, stillborn, 1, 10 days, 1, 2 years, 11, 16 to 36 years, 1, 40 years, 1, 43 years, 1, 60 years. Excluding the 2 infants, 10 were considered male and 5 female. One male, aged 20 years, was reared as a female until he was 17 years old

As to the gonads, in 10, they were bilaterally situated at normal ovarian site with relation to the tubes, in 7, unilaterally so situated with opposite gonad in the scrotum in 4, in 1, in the labium, in 1, in the groin, in 1, in a hernial sac

Microscopic section showed the following combinations bilateral ovotestes in 3, ovary and ovotestis in 3, testis and ovotestis in 1, ovotestis and opposite gonad not sectioned in 4, testis and ovary with separate adjacent testicular structure in 1, bilateral ovaries with separate testicular structure adjacent to both in 1, bilateral ovaries with separate testicular structure adjacent to one in 1

Muellerian derivatives Uterus—in 9, normal, in 5, small, in 2, rudimentary, in 1, minute (4 were bicornate and 1 was unicorn) Fallopian tubes—in 7, normal, in 1, rudimentary, in 1, both without infundibula, in 6, only one, in 2, one normal and other atypical

Wolfian derivatives in 7, epididymis and vas, in 4, vas

Urogenital sinus derivatives Phallus—in 1, clitoris, in 16, penis-like, in 4, penile urethra Vagina—in 3, normal, in 3, small (1, blind, 1, labia resembled scrotum) Scrotum, present in 11

The posterior portion of the vagina connected with the introitus in 5, the posterior urethra in 7, ended blindly in the deep perineum in 1, and the abnormal termination was not determined in 4

Inguinal hernia was present in 6 and in all the gonads were within the sac. A prostate was mentioned in 2

Adult findings In the 14 cases ages varied from 16 to 60. The menstrual function was regular in 8, 4 were regarded as males and in these the uterus connected with the posterior urethra and menstruation occurred as monthly hematuria

In 7, body was of female type—breasts developed in all, beard heavy in 1, scant in 4, absent in 1, and not described in 1

absence or incomplete formation of the testicular appendages. Some degree of development of the muellerian ducts should have resulted if as now usually taught, this structure is prevented from unfolding in males only because it is suppressed by testis hormone. The fact that female pelvic organs were not formed cannot be attributed to adequate testis function and, therefore, it seems plain that the testes have no direct influence upon the muellerian system.

The inference is that maleness is typified, not solely by the presence of testis tissue but, in addition by the absence of muellerian derivatives.

The result of the testis hormone deficiency during the stage of formation of the external genitalia from the urogenital sinus is shown by their female like appearance—a vagina as present in all but 2 and structures resembling labia in all but 1. This undoubtedly accounts for the fact that, in all but 1 case the sex was mistaken. This distortion of the normal male formation of the external genitalia indicates that the urogenital sinus is directly influenced by testis hormone. The failure of development of the prostate and prostatic urethra, in certain cases, are other evidences of normal sex hormone deficiency during early fetal life.

It is significant that, in spite of this decreased endocrine activity, the testes were at some position along the normal migratory course in all cases and outside the peritoneal cavity in all but one.

In the adult group, beardlessness is the most frequent manifestation of the hypogonad condition. The cause of the enlargement of the breasts, which occurred in a few, is obscure. In some cases normal masculine secondary characteristics were well established.

Since none of the abnormalities can be ascribed to the opposite sex hormone influence the individuals of this group are not actual bisexuals. The condition represented might be termed fetal hypogonadism.

Group 2 Female pseudhermaphroditism
In this group were 15 cases. 14 were white, 1 a negro. Four were considered male and 11 female.

There were 8 aged 3 to 21½ years, 6 13½ to 37 years, 1 56 years. As to the gonads all were at the

normal ovarian site. In 2 only one ovary was present. In 3 they were small. In 1 the gonads consisted of thick tissue at the free ends of the tubes. Microscopic sections were examined in 6 and all showed ovarian tissue but in 1 no follicles were seen.

Muellerian derivatives: the uterus in 1 was normal—a 3 year old child, in 4 it was small in 9 infantile or rudimentary, in 1, not described.

The fallopian tubes in 11 were bilateral but in 6 small. In 1 both were cord like. In 1 one was normal and other cord like. In 1, one was absent in 1 not described.

Wolfian derivatives: none.

Urogenital sinus derivatives: the phallus was enlarged and penis like in all 15. The urethra was penile in 1. In another there was a meatus at the tip of the phallus with a short penile urethra. The vagina in 5 was normal in 3 small in 1 blind. The labia were rudimentary in 1 and resembled a scrotum in 1. In the 6 without a vagina there were in 1 a scrotum in 1, a cleft scrotum in 1, folds like a scrotum in 1 rudimentary labia in 2 only one opening the urethral in the perineum. The posterior portion of the vagina was connected with the introitus in 8 with the posterior urethra in 3 ended in the deep perineum in 2 and in 1 the abnormal termination was not determined.

Inguinal hernia was not present in any case. There was no mention of a prostate. Cystoscopy was done in 1 case and no structures resembling those of the prostatic urethra were seen.

Adult findings in 7 cases the ages varied from 13½ to 56 years. Primary amenorrhea was present in all but 1 in which menstruation occurred once. In 2 menes were induced by hormone therapy. 1 it occurred after amputation of the phallus.

One showed female body, breasts developed no beard.

Two showed female body, breasts flat, beard heavy.

Three showed male body, breasts flat, beard heavy in 2 and scant in 1.

In 1 the body form was not described, breasts were flat, beard heavy.

Erections of the phallus were mentioned in 2.

In 2 children, ages 10 and 11½, hair growth was present on the face.

This is another group in which the sex is not a matter of controversy as it is generally accepted that these persons are genetic females.

The absence of testis hormone influence during the stage of development of the wolfian and muellerian ducts is denoted by the non appearance of testicular appendages and except for changes in the tubes in a few instances the integrity of the female generative tract down to its point of connection with the anterior portion of the vagina. Failure of development of a prostate in any case likewise

Wolfian derivatives in 7, vas was present, in 6, epididymis and vas (seminal vesicle in 2), in 1, vasa, seminal vesicles, and ejaculatory ducts

Urogenital sinus derivatives phallus—in 5, clitoris was noted (3, enlarged), in 18, penis (8, penile urethra) Vagina—in 1, it was normal, in 7, rudimentary (2, labia resembled scrotum), in 1, no vagina or scrotum was found In 14, scrotum was noted (2, cleft, 1 resembled labia, 1 contained a testis, 1, a hydrocele, 1, a hernia)

The posterior vagina connected with the introitus in 1, the posterior urethra in 12, ended in the deep perineum in 1 and the termination (abnormal) was not stated in 9

In 1 case (Creevy) on cystoscopic examination many ducts and a bifid verumontanum were seen in the prostatic urethra A prostate was mentioned in 7

Inguinal hernia was present in 6 and the gonads were within the sac in all

Adult findings In the 17 cases, ages 16 to 84, 13 were of male body type, breasts flat in 11 and developed in 2, beard heavy in 6, scant in 2, absent in 2 and not described in 3

Two were described as robust, breasts developed in 1, beard not described

One had female body, breasts flat, beard not described

One showed upper body male and lower female, breasts flat, scant beard

Two were husbands, 1 was a wife, 1 had frequent intercourse with women Erections were mentioned in 4 others

This type of hermaphroditism is characterized by the presence of female generative organs in persons who have gonads composed exclusively of testis tissue At present these individuals are considered males, and the abnormal pelvic organs are said to have resulted because of insufficient testis influence to suppress the muellerian ducts

The validity of this prevailing interpretation of the anomalies of this group is questioned by the evidence, previously presented, which showed that the muellerian system is not testis conditioned Besides this, the findings afford abundant proof of a potent testis influence at an early embryological stage

This is shown by the occurrence of testicular appendages in over half, a prostate in almost one-third and a prostatic urethra in one Migration of one or both gonads to a position outside the peritoneal cavity in 5 cases indicates an early testis influence and the incidence of inguinal hernia is also of some significance in this connection

Certain grotesque features in some cases are suggestive of an early migratory urge These are, the presence of fallopian tubes in the tunica vaginalis testis; uterus, tubes, and gonads in a hydrocele sac, and uterus, tubes, and gonads in the sac of a scrotal hernia

The changes in the muellerian derivatives are more extensive than in the two previous groups, nevertheless, except in 3 cases, the female internal generative organs are well differentiated In the 3 cases in which the uterus was represented by, respectively, a body the size of a bean, club-like rudiments and vestigial muscle fibers, these are better accounted for by early cessation of normal female hormone activity than by the presence of the opposite sex hormone

The formation of a penile urethra in over one-third and a scrotum in over one-half, as well as distortion of the vagina in all but 1 case in which such a structure was formed, which was less than one-quarter of the total, all point to the presence of a potent testis influence during the period of development of the urogenital sinus derivatives In spite of this, the deeper portions show, not male constructions but modifications of female formation

Since the abnormalities are, without doubt, alterations of female structures by an early testis influence, it is evident that ovarian cortical tissue was present originally The gonads, in these cases, represent complete bilateral replacements of ovaries by testis tissue of primary gonadal derivation

The adult findings are those of marked degrees of virilism

In summary, it may be stated that the review of the manifestations in this group show that they were brought about by the onset of the opposite sex hormone influence at a very early stage of fetal development in persons who are genetic females

CLASSIFICATION OF HERMAPHRODITISM

Hermaphroditism may be divided into two classes each of which is distinctive from the clinical, etiological, and embryological standpoints

- 1 The form affecting genetic males
- 2 The form affecting genetic females

In 5, the body was of male type—breasts flat in 2 developed in 1, beard heavy in 2 scant in 1 absent in 1 and not described in 1

In 2, the body type was not described—breasts developed and beard absent in both

Erections of the phallus were mentioned in 7
One was a husband 1 was engaged to a woman and 1 had frequent intercourse with women

According to the prevalent embryological theory, true hermaphrodites embody the essential elements of both sexes since the nature of the gonads is held to denote the sex. Therefore, they are considered bisexuals who under different developmental circumstances, might have been either male or female

According to the biological conception of the embryology of the gonads, true hermaphrodites are genetic females in whom testicular rudiments have persisted and grown to the stage of tubule formation. The latter view affords the more logical explanation for the findings in these cases

The integral testicular structures may be interpreted as complete replacements of what should have been ovaries by abnormally developed primordial gonadal tissue, separate testis masses adjacent to ovaries as developed split-off and ovotestes as abnormal growths within the normal organ

A testis influence at an early fetal stage is apparent from the frequent occurrence of wolffian duct derivatives in this group but although the bicornate and unicorn uterus together with the absence of one tube or changes in one or both denote interference with the müllerian ducts nevertheless on the whole, the female pelvic organs are well differentiated. This again denotes that the müllerian system is not directly affected by testis hormone and it is reasonable to assume that such alterations as did occur were due to an indirect influence by reason of disturbance of the function of the ovary

The situation of the gonads is worthy of comment. A migratory tendency seems to be an inherent property of testis tissue but it cannot be accepted as a distinctive characteristic of a true testis, since one of the gonads which was situated outside the peritoneal cavity was an ovotestis. This factor however may bear some causal relation to the frequency of inguinal herma in this group

The formation of a scrotum in 11 of the 17 cases, the penis like appearance of the phallus in all but 1 and the penile urethra in 4, conform with the observation that the urogenital sinus is directly affected by testis hormone, but the effects produced upon the deeper portions of the vaginal tract do not differ from those observed in the group of female pseudohermaphrodites

Curiously enough, however in many instances the testis influence subsided thereafter as is shown by the establishment of menstruation in over half of the adults and the absence or relatively slight signs of virilism in the majority

This survey of the abnormalities in cases of true hermaphroditism clearly indicates that embryologically, they are opposite sex hormone disturbances of female structures and that, therefore, these individuals are female in the genetic sense

Group 4 Male pseudohermaphroditism, with müllerian derivatives There were 23 cases 21 white, 1 colored, 1 Chinese

The age incidence was as follows 1, new born, 1 13 days 4 11 to 15 years 15 16 to 39 years 1 52 years 1 84 years

Excluding the two infants 13 were considered male and 8 female

In 17 the gonads were at the normal ovarian site with relation to the uterus (in 1 this position was slightly modified and in another only 1 gonad was present) In 2 one gonad was at the ovarian site the opposite was in the scrotum in 1 and in the groin in 1 In 2 both gonads were in the groin In 1 there was only one gonad which was in the scrotum In 1 the only gonadal tissue was a teratoma of the testis below the left kidney Teratomas of the testis were present in 3 other cases

Microscopic section showed only testis tissue in all

Müllerian derivatives Uterus—in 9 it was small in 11 rudimentary in 1 the size of a bean (2 were bicornate 1 was unicorn 3 were in a hernial sac 1 was in a hydrocele sac), in 2 it was vestigial (1 consisted of tubers attached to tube in tunica vaginalis testis and the other of club like remains of a bicornate uterus)

The broad ligament was absent in 2 and poorly developed in 1

Fallopian tubes in 6 they were normal in 8 rudimentary in 1 none in 2, only one (1 caseous) in 1 one in each tunica vaginalis testis in 5 one or both atypical (cord like closed ends without lumen)

such persons in the environment of their correct sex if their later life is aggravated by a complication which makes it difficult for them to interpret their emotions. Prepubertal care, therefore, should include measures designed to prevent later erections of the clitoris, namely, surgical removal of the testicular structures, even though this involves complete gonadectomy in cases with either bilateral testes or bilateral ovotestes.

No definite recommendation can now be made concerning the ablation of testis tissue in female pseudohermaphrodites since the lesion is not known but, as previously stated, study of the hilar area of the ovaries in this condition is urged upon those who may have the opportunity to do so.

The presence or absence of abnormal sexual symptoms should largely govern the management when hermaphroditism in genetic females is not discovered until the patients have become adults.

Erections of the phallus in genetic females are pathological, even though some of these individuals have well marked somatic and psychical traits of masculinity. The erections may be so strong that male-like potency becomes established. Should such individuals contemplate matrimony as males, in justice to the intended wife, the true state of affairs should be made known and correctional procedures advised. Genetic females with no abnormal sex urges, who have become economically adjusted as males, may be left undisturbed.

Amputation of the clitoris to relieve turgescence has been used with beneficial results and in one of O'Farrell's cases, a female pseudohermaphrodite, this procedure was followed by the onset of menstruation.

In cases of genetic males who have reached adulthood under the mistaken impression that they were female management is also affected by the question of sexuality. The new status may be welcomed by those who have themselves doubted the normality of their previous state but those in whom innate sexuality is wanting and who, in consequence, have become imbued with feminine qualities, may deeply resent any suggestion of a change. Contemplation of this factor has led some

surgeons to consider it kinder to emasculate such individuals and thereafter keep them in ignorance of the true situation. This practice is contrary to the inalienable right of everyone to know the facts about themselves.

In dealing with sensitive persons of this class, it would seem to be better to inform them of their true sex but to add that although they are really male, nevertheless, they lack the activating endocrine stimulus of virile manhood and to point out that this does not affix femininity.

Correction of abnormalities of the accessory structures by plastic operations is often difficult because of extensive changes. The literature contains descriptions of admirable methods devised for these purposes but a consideration of these is not within the scope of this paper. It may be pertinent to state that such measures should not be undertaken until the actual sex has been determined.

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The abnormalities of the first group are the result of deficient normal sex hormone activity during fetal development. It is the only form of pseudohermaphroditism. The clinical findings include various degrees of maldevelopment of the testes and female like abnormalities of the external genitalia. The wolffian duct derivatives may be incompletely developed or absent but müllerian duct derivatives do not appear.

The second class is characterized by the presence of organs derived from the müllerian system. These structures and not the nature of the gonads distinguish genetic femaleness from genetic maleness. This class, therefore, embraces the conditions now designated female pseudohermaphroditism and true hermaphroditism and, in addition, those individuals with female pelvic organs who because the gonads are composed entirely of testis tissue, are now classified as cases of male pseudohermaphroditism.

The manifestations in all three groups are due to the action of the opposite sex hormone upon female structures and for this reason they are all conditions of actual hermaphroditism.

Variations in the masculinizing effects depend upon the embryological stage at which the abnormal hormone influence arose as well as of course the intensity of this endocrine disturbance.

DETERMINATION OF THE SEX

Laparotomy is now frequently employed to determine the sex in cases of hermaphroditism because for reasons previously discussed it is considered necessary to rely upon examination of the gonads to settle this question. The external manifestations are generally regarded as unreliable and misleading.

This study indicates that the external genital findings are diagnostic of femaleness whenever a cervix or uterus can be demonstrated.

Instrumental exploration of the external genitalia, as described by both Young and Creevy, are valuable. These include endoscopy, vaginoscopy and roentgenograms of vaginal and urethral orifices after injection with opaque solutions.

Absence of a cervix does not exclude femaleness, as the posterior portion of the vagina may be separated from the introitus by a partition. Failure to demonstrate a uterus by either bimanual or rectal examination does not exclude its presence but palpation of a mass that might be a uterus should arouse suspicion of femaleness.

An orifice in the posterior urethra is suggestive of urethral communication of the posterior vagina but is not conclusive, as Young has found that such openings may connect with persistent urogenital pouches in the penneum.

The presence or absence of a prostate does not indicate the sex nor does male like formation of the external genitalia deny femaleness. Beard growth in children should arouse suspicion of femaleness. Inguinal hernia may afford a clue to unsuspected hermaphroditism.

MANAGEMENT OF HERMAPHRODITISM

The three principles of proper care of cases of hermaphroditism are (1) to have patients reared in the correct sex, (2) to relieve abnormal sexual symptoms (3) to restore the accessory structures to a normal condition.

The first depends upon diagnosis of the true sex at an early age and is, of course, of great importance in the prevention of later emotional conflicts. This phase of management is of particular gravity in cases of hermaphroditism in genetic males. In some of these sexuality is of such minimal spontaneity that, if reared as females, they become adapted to the psychical as well as the social aspects of their training and it is a trying interlude in their lives and in the lives of those dear to them when the true situation is not discovered until after such habits have been formed. In other instances in which males are reared as females, normal sex urges may become manifest after puberty and their companions may be subjected to adolescent tribulations.

The problem of early management of hermaphroditism in genetic females should be weighed with reference to the possibility that abnormal sexual symptoms may arise later by virtue of internal impulses acting upon the phallus. It is of slight advantage to educate

CLINICAL SURGERY

FROM ST. MARK'S HOSPITAL FOR DISEASES OF THE BOWEL, LONDON

PERINEAL EXCISION FOR CANCER OF THE RECTUM

J P LOCKHART-MUMMERY, F R C S, F A C S, London, England

IT has always been my opinion that an operation for cancer of the rectum cannot be considered really satisfactory unless it can be used with a reasonable degree of safety in those cases in which the patient is a bad subject for operation. Cancer of the rectum is a disease of advanced life, and it follows that many of the patients are bad subjects, owing either to their age or to some complicating disease. An operative technique which requires that the patient shall be a first class subject will either be accompanied by a serious mortality or be available only as a means of curing the disease for a small percentage of cases requiring treatment.

When I first began to practice surgery, the mortality from operations for removal of the rectum was very high, in the neighborhood of 30 per cent, so I started to devise a technique which would enable this mortality to be reduced to more reasonable limits. The operative technique here described has stood the test of time, and has achieved the objects at which I aimed. The mortality should not be more than 4 per cent, and the recurrence rate, as revealed by the follow up of 500 cases, is only a little over 40 per cent on a 5 years basis. This at least is as good as for carcinoma in any other site or treated by any other method.

I have described this operation on previous occasions, but as some surgeons may not have had the opportunity of reading such descriptions, it has been suggested to me that a detailed account of the operation as now performed will be of interest.

TECHNIQUE

The operation for removal of the rectum by the technique here described is suitable for any case in which the growth is at the anus or anywhere in the rectum proper, provided the tumor is not seriously fixed to important structures. It should not be performed when the growth is at the rectosigmoid junction, in this situation the perineo-abdominal operation is preferable.

Eminent Surgeon, St Mark's Hospital for Diseases of the Bowel, London, England

The anesthetic I am quite convinced that the best anesthetic for excision of the rectum is spinal anesthesia. Either stovaine, novocain, or percaïne may be used, my own preference being for a low stovaine anesthesia, percaïne should not be required as the operation does not take more than 45 to 50 minutes. If, however, the surgeon has reason to believe that he cannot perform the operation in this time, percaïne anesthesia should be preferred. Some basal anesthetic in addition should always be used so that the patient is unconscious. An excellent combination is avertin and low spinal anesthesia, or twilight sleep and spinal anesthesia. Any form of inhalation anesthetic should be avoided if possible. Inhalation anesthetics, however carefully administered, are liable to cause chest complications, and after the operation the patient will have to be nursed lying down and cannot sit up. This is a serious handicap if bronchitis or pneumonia supervenes, and for that reason I have always refused to allow any form of inhalation anesthetic to be used. In exceptional cases local, or regional, anesthesia may be substituted for spinal, but are rather troublesome. I have had no complications with a stovaine spinal anesthesia in a very large number of cases. It has always been my rule that when a spinal anesthetic is given the patient should be kept slightly head-down from the time that the operation commences for at least 3 or 4 hours. This, I consider, most important in protecting the patient against the effects of gravity during the time that a large part of the vasomotor system is not functioning. Complications from spinal anesthesia have been quite unimportant in my series.

The operation as a rule is performed in two stages, a preliminary colostomy followed in about 10 days by the excision of the rectum. The operation can safely be performed in one stage in exceptional cases, but is, in my opinion, more safely performed in two stages.

No special preparation is required for the colostomy. The incision should be made through the outer border of the left rectus muscle, the muscle being separated so that it will ultimately

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If the patient is a woman the vagina should have been douched out prior to the operation and 2 hours beforehand packed with gauze soaked in brilliant green or some suitable antiseptic.

The patient should lie on the left side with the buttocks slightly over the edge of the table and the knees well drawn up, and a large piece of cotton wool should be placed to prevent blood or fluid getting between the legs. The right arm should be supported on a rest so as to take pressure off the chest, and the table should be slightly tilted head downward. A really good spot light, which will throw a good beam into the depths of the wound, must be provided, the ordinary type of overhead light being unsuitable.

The first step in the operation is to close up the anus so that no leakage can occur while the rectum is being removed. This is best done with a large curved needle and a piece of stout silk. The curved needle is put in just in front of the anal opening, passed round one side and brought out at the midline at the back, reinserted again through the same opening and brought out in front. This is tied firmly, the ends cut off and another skin suture placed just outside it. This is done before the surgeon puts on his gloves and before the field of operation is prepared or the towels put in position.

After the area has been well treated with iodine some mastich is applied around the wound, except just where the incision is to be made, and a piece of thin mackintosh is stuck on to the skin on either side, leaving only the actual line of incision exposed.

An incision is now made, starting from the base of the sacrum and being carried forward so as to surround the anus completely and to finish about 1 inch in front of it (Fig. 2, A). This incision is deepened into the ischio-rectal fat on either side. Next the coccyx is exposed and disarticulated (Fig. 2, B). The best method of doing this is to press the tip of the coccyx inward with the left thumb and then with a knife the joint can easily be found and divided without the use of a chisel. If, as not infrequently happens, the space available for removal of the tumor is very narrow, or the tumor is rather large, further room can easily be obtained by removing another inch of the lower end of the sacrum with a chisel and hammer. The coccyx having been disarticulated, the deep fascia beneath it is now cut through on either side and the first finger of the left hand is passed forward underneath the levator ani so as to guard the rectum. The lower side should be cut first: when this finger is in position the rectum should be behind it and the levator ani over the top of it, in

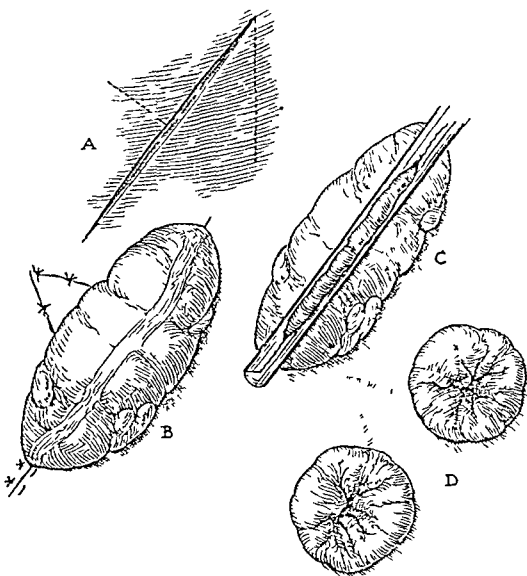


Fig 1

other words, it protects the rectum from being injured (Fig. 2, C). With a stout pair of scissors the levator is now divided all along to a point in front of the anus, bleeding points being picked up by an assistant. The same is now done on the opposite side and the rectum will now be free laterally.

The next step is to dissect the rectum from the prostate or vagina. This part of the dissection must be made boldly with straight, blunt scissors, care being taken not to injure the rectum behind or the urethra or vagina in front (Fig. 2, D). In a female the posterior vaginal wall is defined and followed straight upward until the peritoneal reflexion is met with, this may easily be checked by passing the finger into the vagina from time to time as a guide to the scissors. It must be remembered that this septum between the rectum and the posterior vaginal wall is often very thin, and the dissection should be kept as close as possible to the back of the vaginal mucous membrane. As a rule the extremity of Douglas's pouch will be met with 1.5 to 2 inches from the skin. Occasionally, however, in multiparous women, or women who have suffered from pelvic inflammation or operations, the peritoneal reflexion may be very much higher than usual and care must be taken not to make a mistake by opening the rectum instead of the peritoneal cavity.

In the male the dissection is carried up between the rectum and the posterior wall of the urethra. The catheter in the urethra can be felt with a

enclose the opening and give the patient considerable control over the colostomy later on when he is walking about and the muscle is contracted. The bowel is opened 36 hours after the operation, and before the second operation is performed that portion of the bowel between the colostomy opening and the anus must be thoroughly washed out so that there are left no fecal contents at all. This is a very important detail. At the time of performing the colostomy the abdomen should be carefully explored to ascertain the upper limits of the growth, the possible presence of malignant glands, and secondary deposits in the liver or elsewhere.

The anesthesia for the preliminary colostomy should be avertin, as this will give a good idea as to how the patient behaves under avertin anesthesia before the second and more serious operation is undertaken. As regards the abdominal wall, nerve blocking with novocain is quite satisfactory, or local anesthesia provided the surgeon is very gentle while exploring the abdomen where sensation will not be properly controlled by the anesthetic.

The preliminary colostomy. Any type of colostomy which results in a good spur will be satisfactory, but I have found in the course of many years' experience that the ordinary form of colostomy in which the spur is formed by means of a glass rod is liable after a time to become unsatisfactory. Many of these patients are likely to put on weight and this may result in the spur retracting. If feces succeed in getting into the lower opening they tend to accumulate and as they have no exit except upward may cause a good deal of trouble. To get over this difficulty I have for some years performed the colostomy in such a way that the two openings are separated by at least 1 inch of skin. This entirely obviates any risk of the spur becoming inefficient and of feces obtaining access to the blind loop of colon.

The incision should be made just long enough to allow the surgeon's hand to pass through into the abdomen. If the abdominal muscles are relaxed by spinal or regional anesthesia a comparatively small incision will be quite sufficient. After the abdominal cavity is explored a loop of the sigmoid colon is drawn up through the incision and the mesocolon is cut transversely so as to leave a gap of 1 to 1.5 inches any bleeding vessels being tied off. The peritoneum is now sewn together through this gap in the mesocolon so that the colon comes out at the upper and lower ends of the wound. Next, the aponeurosis is similarly stitched together through the gap in the mesocolon and a triangular flap of skin is next cut

from the upper or lower end of the wound which ever is most convenient on the outer side and drawn through under the bowel and stitched into an incision on the opposite side so as to form a complete skin bridge underneath the colon, as shown in the diagram (Fig. 1, A and B). Lastly, a small clamp is placed on the free side of the colon so as to enclose a length of about 1.5 inches of all the coats of the bowel between the blades. This clamp is left in place, and when it is desired to open the bowel all that will be necessary will be to remove the clamp and cut away the gangrenous tissue between the blades (Fig. 1, C). Thus we'll leave the colon wide open, and the patient will not be aware that it is not part of the ordinary dressing. If the bowel has to be cut open either with scissors or the cautery, although it causes no pain the patient is apt to look upon it as a sort of operation and the clamp saves a great deal of trouble.

Care must be taken in performing this operation to see that the bowel is not unduly constricted or its blood supply in any way damaged. No glass rod need be placed under the bowel as it cannot retract because of the bridge of abdominal wall beneath.

Some 8 to 10 days after the operation a stout silk ligature should be passed under the colon and tied firmly on to it. This will come away in the course of a few days and leave two totally separate openings divided by about 1 inch of skin (Fig. 1, D). The period which elapses between the performance of the colostomy and the excision of the rectum will allow of the patient being carefully prepared and everything done to make the second operation as safe as possible.

If any complication such as bronchitis should occur after the colostomy or if it should seem desirable for other reasons the second operation may be postponed until the patient is in as good health as can be managed.

Excision of the rectum. If the patient is a male, a gum elastic catheter should be tied into the bladder or a self-retaining catheter used. This is to act as a guide to the urethra during the performance of the operation. The catheter may be put in before the patient goes up to the operating theater or can be passed after the spinal anesthetic is administered.

I prefer to perform the operation in the left semi-prone position. Some surgeons prefer to use an exaggerated lithotomy position or to use the complete prone position obtained by a Flanck table. The left semi-prone position is the most comfortable from the patient's point of view and less apt to be followed by muscular pains after ward as the position is a natural one.

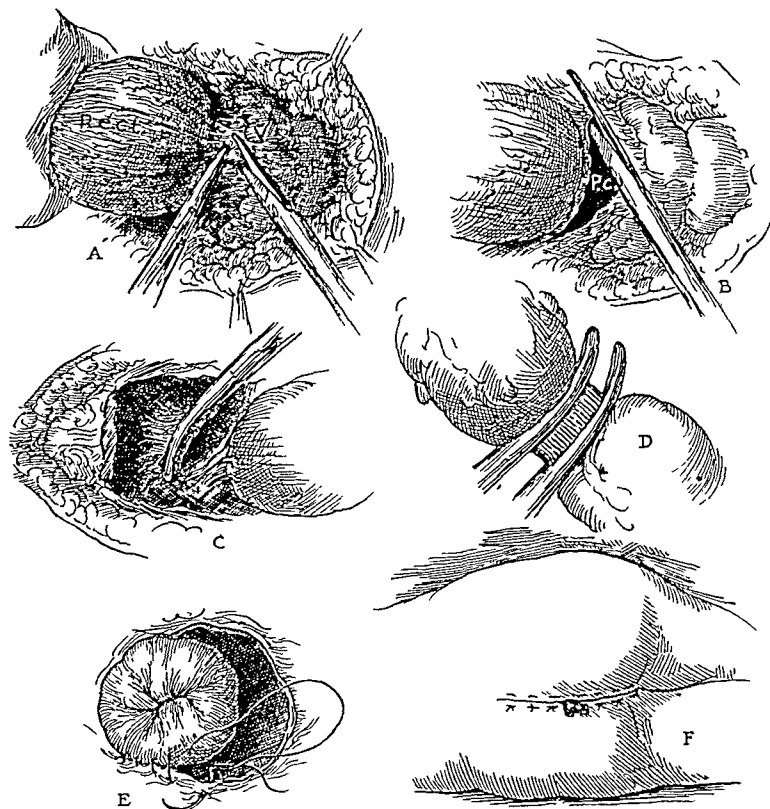


Fig 3.

clamps is to pass a loop of the ligature over the tip of the clamp, then twist the curved clamp sideways, this will make it quite easy to tie off the clamps with only one finger in the wound (Fig 3, C) It remains now only to divide the colon. The rectum and colon should be drawn down into the wound as much as they will come and large swabs soaked in antiseptic placed so as completely to shut off the rest of the wound.

With a knife the outer coats of the colon are divided down to the back of the mucous membrane and the muscular coat is stripped back for about $\frac{1}{4}$ inch. If this is carefully done there should be only the mucous membrane left. This is now caught in a large clamp with longitudinal grooves and crushed, a similar clamp being placed $\frac{1}{4}$ inch below it. The bowel in between is now divided with a cautery and the rectum can be removed (Fig 3, D). The end of the colon is closed up by a stout catgut ligature, and the clamp is removed. Next a pursestring suture is inserted about $\frac{1}{2}$ inch away from the closed end, and the

latter is inverted by an assistant while the suture is being tied. The swabs are now removed and, all bleeding having been stopped, the swab in the peritoneal cavity is taken out. With a small curved needle on a long needle holder the peritoneal opening is closed. For this purpose I prefer to use a small curved eyeless needle and No. 1 catgut. The stitch should be commenced on the lower lateral aspect so as first to close in this lower corner (Fig 3, E), the peritoneum being stitched to the stump of the colon so as to leave the inverted end outside the peritoneal cavity. When the stitch reaches the middle line another one should be started from the opposite corner and the two finally tied off in the middle. Great care should be taken to ensure that the peritoneal cavity is completely closed and that no gap is left through which a bit of small intestine might prolapse.

The large wound is now carefully swabbed out and any points that are oozing are tied off. A large, flat piece of thin rubber dam is next pushed into the wound and packed inside lightly with gauze.

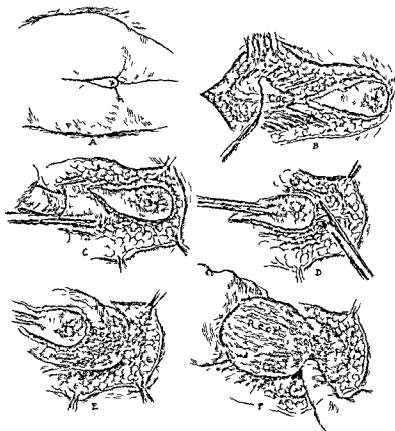


Fig 2

finger in the wound and acts as a useful guide. The dissection should be kept as near the urethra as possible to prevent any danger of damaging the rectum but on no account must it be carried up in front of the prostate. The prostate should be reached about 2 to 3 inches from the skin and can be easily felt with the finger (Fig 2, E). As soon as the posterior wall of the prostate comes into view, a few snips with the scissors will free the rectum and with a swab the rectum can be stripped back away from the prostate so that the whole lower and posterior surface of the prostate is exposed. As this stripping is carried backward the two vesiculæ seminales will come into view, one on either side (Fig 2 F). The stripping should now be continued so as completely to expose both vesiculæ. It is most important at this stage that the dissection should not be taken up between the prostate and the vesiculæ as if this is done, the trigone of the bladder will be damaged; the dissection must be kept behind both vesiculæ.

When they are both well defined the structure immediately behind them between them and the rectum should be the peritoneum. By picking it up with a pair of forceps it can generally be quite easily defined and opened by a snip of the scissors (Fig 3, A). The opening in the peritoneum should now be widened and a large gauze pack with a tape attached to it or the end of a roll of gauze should be pushed into the peritoneal cavity to protect the intestines and prevent blood getting into the peritoneal cavity. Next the peritoneum is divided cutting quite close to the rectum as far backward as possible on both sides (Fig 3 B), the rectum is now drawn forward and its fascial attachments behind and laterally freely divided with scissors. The rectum should not be entirely free except at its attachments to the colon and mesorectum. The mesorectum is next clamped off with curved clamps as high up as possible divided and the clamps tied off with stout catgut. The space is rather limited and the best way of tying off these

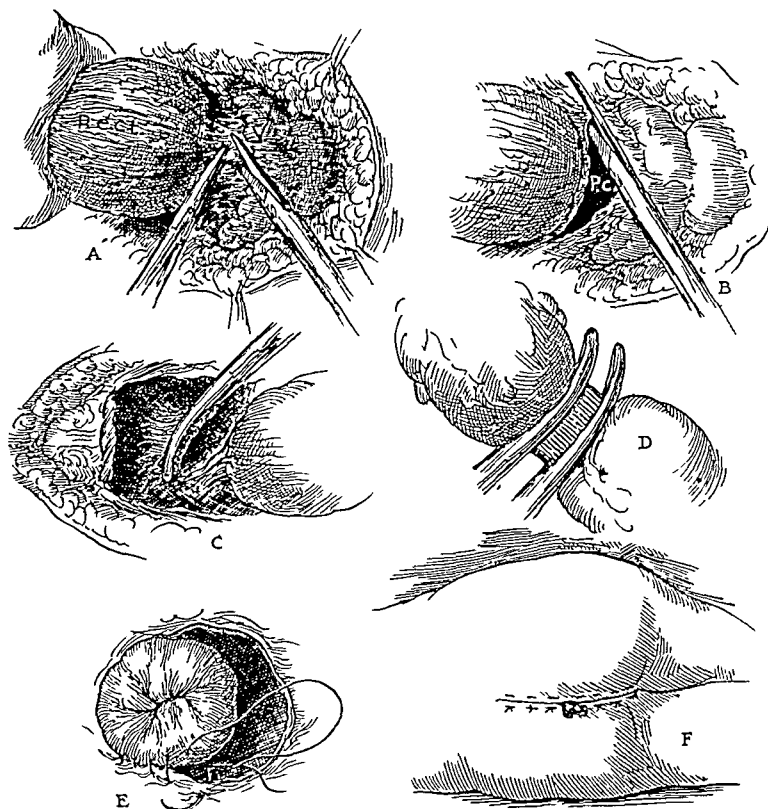


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clamps is to pass a loop of the ligature over the tip of the clamp, then twist the curved clamp sideways, this will make it quite easy to tie off the clamps with only one finger in the wound (Fig. 3, C). It remains now only to divide the colon. The rectum and colon should be drawn down into the wound as much as they will come and large swabs soaked in antiseptic placed so as completely to shut off the rest of the wound.

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soaked in 1:1,000 acriflavine. The edges of this piece of rubber are brought out as a drain in the middle of the skin wound. It is not necessary to use a large pack and no part of the gauze should come in contact with the wound where it may become stuck. The wound is closed with fish gut mattress sutures, just the end of the rubber dam being left projecting between two of the center sutures (Fig. 3, F).

This operation has frequently been performed in 25 minutes and unless special difficulties are encountered should not take more than 45 minutes. It can be performed rather more easily and quickly in the female than in the male. This is because separation from the vagina is more easily performed than separation from the prostate and also because the female pelvis is wider and affords more room to work in. Should the posterior vaginal wall be involved in the tumor, it can be removed with the rectum and the posterior vaginal wall subsequently repaired. Provided the peritoneum is divided close to the rectum, there is no risk of damage to the ureters nor any necessity to define them.

AFTER TREATMENT

If the patient is a very bad subject, or the operation has been a particularly severe one, a transfusion with human blood should be made after the patient gets back to bed. It is very seldom, however, that this is necessary.

There should be very little shock from the operation and the amount of blood lost should be quite unimportant.

As a rule the dressings are not interfered with for 48 hours. In the male the catheter is left in place for 3 to 4 days and the urine is drawn off at regular intervals. In the female catheterization will have to be carried out for a similar period.

Three or 4 days after the operation two of the sutures should be cut and the packing and drain removed. It is better to leave a fairly large opening so as to give free drainage without the necessity of putting in tubes though later on, when the wound is healing, a tube is usually necessary. The tube should be shortened only very gradually, so as to give the cavity plenty of time to close in. A drainage tube should not be used immediately after the operation, as it is impossible to prevent air getting in and infecting the blood clot in the wound. By keeping the wound cavity closed during the first few days granulations are able to form on the wall of the cavity which will protect the patient against sepsis. The rubber tissue does not stick to the walls of the wound and the granu-

lations are thus protected from damage, when it is removed, the wound should heal quite aseptically, but healing will take a considerable time because the cavity which has to close in is large. It should, as a rule, not be necessary to flush out the wound with antiseptics unless it becomes septic.

The greatest difficulty, as a rule is with the bladder, retention of urine almost invariably occurs 2 or 3 days after the operation and for this reason it is better to catheterize the bladder regularly, or to use an inlying catheter. The greatest care, however, should be taken to prevent bladder infection. The presacral nerves passing from the sympathetic ganglia to the bladder have almost certainly been damaged when removing the rectum, and it is this that causes difficulty with retention. The retention is only temporary and provided the bladder can be properly drained for a few days without sepsis, normal bladder function will soon be restored.

In order to prevent infection of the bladder some surgeons use a vaccine or wash the bladder out twice a day. What is known as a 'Dukes' apparatus for attaching to an inlying catheter is a great help at this stage in preventing bladder infection. It consists of a system of tubes permanently attached to the inlying catheter, and so arranged that the urine can be drawn off by opening a clip and the whole system irrigated with warm oxy-cyanide solution (1:5,000). The catheter and all the apparatus will be filled with oxy-cyanide and not with urine. The use of this apparatus has very materially reduced the incidence of bladder infection in these cases.

The patient will have to be nursed on his side or on his back and cannot be allowed to sit up for the first 2 weeks. A good mattress and good nursing are, therefore, very essential. There should be a pulley over the bed by which the patient can pull himself about by lifting himself with his arms.

At the end of 10 days or a fortnight the patient should be got out of bed into a bath daily. In the bath a patient only weighs a few ounces and consequently will be able to move about and sit up in the bath much more comfortably than he can in bed.

From this time on the patient should be encouraged to move about but he will not be able to sit in comfort for another week or two. As a rule the patient is able to return home in about 3 weeks or a month from the second operation.

The wound in a male, will not heal for several more weeks because of the large cavity which has to fill up.

THE TREATMENT OF SEVERE HYPERTHYROIDISM AND THE BAD RISK PATIENT

GEORGE CRILE, Jr., M.D., Cleveland, Ohio

THE complications of hyperthyroidism (thyroid crisis, cardiac decompensation, etc.) which are so difficult to treat are, in the majority of cases, relatively easy to avoid. We must, therefore, anticipate the complications that are likely to arise and treat them prophylactically before they develop. To accomplish this, it is important to appreciate fully the factors that influence the risk of thyroidectomy.

From an analysis of a group of 9,630 consecutive cases of hyperthyroidism treated by surgery at the Cleveland Clinic Hospital, we have determined that the chief factors influencing the risk of thyroidectomy are (1) the condition of the heart, (2) the age of the patient, (3) the response of the pulse curve to pre-operative treatment, and (4) the degree of extension of the goiter into the thorax.

Of less importance are the presence of a rapid pulse rate at the time of the patient's entry to the hospital, a history of marked loss of weight, or the finding of a high basal metabolic rate. Except in special instances, the prognosis is not materially altered by the duration of the disease.

Heart disease. It is generally agreed that the presence of cardiac decompensation, auricular fibrillation, valvular heart disease, or severe myocarditis increase the risk of performing a thyroidectomy on a patient with hyperthyroidism. In this series, the mortality rate in patients with auricular fibrillation was nearly seven times as high as when this complication was not present.

Age. Next in importance to the condition of the heart is the age of the patient. In patients over 60 years of age, not only is the myocardium apt to be damaged by vascular changes, but the kidney reserve tends to be low and the margin of safety in liver function is often diminished. Pneumonia is a constant threat to the feeble patient in advanced years, hence it is not surprising to find that the postoperative mortality rate in patients over 60 years of age is more than four times as high as in patients under 60.

Pulse curve. Although the pulse rate at the time of entry to the hospital does not bear any striking relationship to the postoperative mortality rate, the response of the pulse curve to pre-

operative treatment has a definite bearing upon the operative risk. Thus the prognosis of a patient who enters the hospital with a pulse rate of 160 is good, provided the pulse curve falls satisfactorily before the operation (Fig. 1). But a patient whose pulse rate is 120 at the time of entry and 10 days later is still 120 may not be a good operative risk (Fig. 2). This type of pulse curve was more than five times as common in the group of patients who died after operation as in those who survived. The physiological indications of a remission of hyperthyroidism are a falling pulse curve and a gain in weight. When the disease is entering a remission, severe thyroid reactions are not apt to occur, but when, in spite of iodine and bed rest, the hyperthyroidism remains stationary or increases in severity, a thyroid crisis may be initiated by the slightest provocation.

Intrathoracic goiter. When hyperthyroidism is associated with an intrathoracic goiter, the risk of operation is nearly four times as great as in the patients in whom the goiter does not extend into the thorax. The reason for this is not clear but, since the average age of the patients with intrathoracic goiter in this series was 50, it is quite possible that age as well as the mechanical factors involved in the removal of an intrathoracic goiter may be a potent factor in increasing the risk.

Duration of hyperthyroidism. In our experience the relation of operative risk to duration of symptoms has not been striking. The mortality rate in patients having hyperthyroidism longer than 2 years was only one and one-half times as great as in the patients having hyperthyroidism for less than 2 years. The severity of the postoperative reaction of the pulse and temperature depends to a large extent on the actual severity of the hyperthyroidism at the time of operation. It is true that long standing, severe hyperthyroidism can result in great loss of weight, in impairment of liver function, and in a serious depletion of the patient's resistance to intercurrent infection, especially pneumonia. There is, however, little evidence to indicate that the myocardium suffers any specific damage (5) as a result of long standing hyperthyroidism or that the heart is less able to cope with a postoperative thyroid crisis of a given severity, whether the disease is of short or

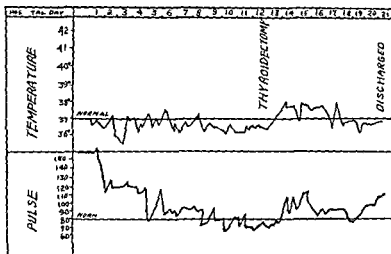


Fig. 1 Satisfactory fall of pulse curve before operation an indication of a favorable prognosis

of long duration. The majority of patients with hyperthyroidism of long duration suffer from a relatively mild form of the disease and can withstand the minimal postoperative reaction which occurs in patients with mild hyperthyroidism.

Loss of weight. In older patients a history of loss of considerable weight may be an indication of an unfavorable prognosis, but in younger patients the risk of operation does not seem to be materially increased by loss of weight up to one fourth of the total body weight. In this series the mortality rate was approximately three times as high in those patients who had lost over 25 pounds of weight than in those who had lost less than this amount, the greatest mortality occurring in the oldest patients.

Basal metabolic rate. The highest operative mortality rate occurs in elderly patients. This group consisting largely of patients with nodular goiters and cardiac manifestations of hyperthyroidism, do not as a rule have as high basal metabolic rates as the younger patients with diffuse goiters and relatively acute hyperthyroidism. The risk of thyroidectomy is dependent not so much upon the severity of the hyperthyroidism as upon the ability of the myocardium and of the individual as a whole to cope with the postoperative reaction. Hence, we are not surprised to find that in this series the risk of operation on patients with basal metabolic rates above plus 50 per cent was only three times as great as in those with basal metabolic rates below plus 50 per cent. If, however, the basal metabolic rate, along with the pulse

curve, fails to fall in response to preoperative treatment and remains excessively high (above plus 80 per cent), the operative risk is still further increased.

Special types of patients. There are several types of patients who present special risks. The first type is the unco-operative, high strung foreigner. When hyperthyroidism develops in these patients, their innate emotionalism is tremendously exaggerated and their lack of insight, often based on inability to understand English, makes them extremely active and unco-operative. After operation, when rest is essential, the emotionalism of this type of patient may result in the development of a thyroid crisis (Fig. 3).

The second type is the long recognized "burnt out" hyperthyroid so aptly described by Lahry (7) as the patient with "apathetic" hyperthyroidism. This type of patient (Fig. 4) is generally over 40 years of age, does not appear to be actively stimulated, and often has a relatively low basal metabolic rate. As a rule the hyperthyroidism is of long duration and it is in this rare type of patient that a history of long standing hyperthyroidism increases the risk of operation. In the patient shown in Figure 4, a mild thyroid crisis followed upon the minimal trauma of falling out of bed.

When a patient with hyperthyroidism becomes delirious it is unwise to attempt any surgical procedure. Unless the patient shows a striking response to pre-operative treatment even a pole ligation may result in a fatal thyroid crisis.

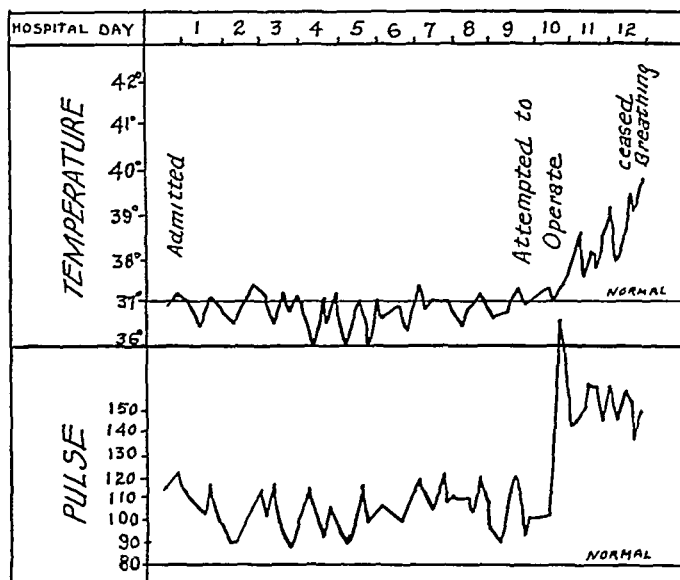


Fig 2 "Flat" pulse curve—fatal outcome Temperature chart of a highly emotional patient aged 50 years, with a basal metabolic rate of plus 31 per cent and pulse 120 at entry. The pulse was still 110 to 120 after 9 days of iodine and bed rest. The patient was draped for operation but this was cancelled because of her severe emotional reaction. Only nitrous oxygen analgesia was given, the patient never being unconscious. Fatal thyroid crisis promptly followed the attempt to operate.

PRE-OPERATIVE CARE

Diet. When a patient with hyperthyroidism has a basal metabolic rate of plus 100 per cent, the basal caloric requirement is increased by 100 per cent over the requirement of a person of equal weight with a normal metabolism. When a sufficient caloric intake is not provided, such a patient must find fuel for the demands of metabolism and in so doing will literally burn herself up. The glycogen of the liver is depleted, fat rapidly disappears, and weight is lost with amazing rapidity.

Unless a concentrated high caloric diet is given, it is often impossible for a patient with a high basal metabolic rate to eat the bulk of food necessary to maintain her weight. The diet should contain large amounts of carbohydrate in order to replenish the depleted glycogen reserves of the liver. In addition, since the serum proteins tend to be lowered in severe hyperthyroidism, the diet should be relatively high in protein.

The importance of diet in the pre-operative treatment of patients with severe hyperthyroidism can scarcely be overemphasized. On several occasions I have observed states of mental confusion following restrictions of diet and in one instance a mild thyroid crisis developed. This patient, a

man 43 years of age, had a basal metabolic rate of plus 96 per cent. A pole ligation had been performed and, through a misunderstanding of orders, he was put on a limited diet such as is given to patients after abdominal operations. There was no immediate reaction to the surgical procedure but 6 days later the patient became delirious, refused food, the pulse rate and temperature rose, and for 10 days he was critically ill. The usual treatment with iodine and the continuous intravenous administration of a 5 per cent solution of glucose was given, but the symptoms did not subside until an intake of 6,000 calories was restored by feeding through a nasal tube.

Sedation. Sedatives are valuable during the pre-operative period, and experience has shown us that bromides or codeine are of more value than barbiturates in patients with hyperthyroidism. Occasionally, especially in older patients or in cases of extreme hyperthyroidism, barbiturates will excite the patient or may even precipitate a maniacal state. The barbiturates and bromides are contra-indicated in the presence of mental confusion because, occasionally, the delirium is the result of the prolonged use of these drugs.

before the patient was admitted to the hospital

Iodine Iodine, as shown by Plummer, brings about a striking effect in the control of hyperthyroidism and should be given before operation is undertaken in cases of hyperthyroidism as associated with any type of goiter, either nodular or diffuse

Psychological considerations The sudden appearance of a stranger with an unfamiliar apparatus such as the gas machine may, in itself, be sufficient to precipitate a severe emotional reaction in a patient of unstable makeup. We have seen a fatal thyroid crisis initiated by draping a patient for operation and administering the lightest gas oxygen analgesia although the operation was cancelled because of the patient's emotional reaction (Fig 2). It is therefore advisable, in cases in which it is best to avoid basal anesthetics, to have the anesthetist visit the patient daily, administer inhalations of oxygen, and gain the patient's confidence.

Morphine is a valuable adjunct to surgery performed under local anesthesia. The tolerance to morphia, as well as to basal anesthetics and to the majority of depressant drugs, varies in direct proportion to the basal metabolic rate of the patient; the drugs being quickly metabolized without exerting their full pharmacological effect when the metabolism is high.

Since we believe that morphine produces less excitation, less depression and more analgesia than any other drug, we give as large a dose as the patient will safely tolerate when the operation is to be completed under local anesthesia. The amount given is based on the basal metabolic rate, the weight, and the age of the patient, and varies in adults from $\frac{1}{4}$ to $\frac{1}{2}$ grain.

The oxygen tent is used routinely after operation on bad risk patients. Occasionally the patient will be confused after operation and will awake to find herself enclosed in a tent and may strike at it and exhaust herself in demanding that it be removed. In order to avoid this issue several days before the operation the bad risk patient is placed in the tent for a few minutes so that she can overcome any apprehension that she might have in regard to the tent.

Digitalis Before operation, full doses of digitalis are given to patients in whom there is evidence of cardiac decompensation to patients with auricular fibrillation, and to patients with valvular or myocardial heart disease. In addition, digitalis is given to a large proportion of the elderly patients with vascular disease of the type in whom we know that the incidence of post-operative auricular fibrillation is relatively high.

THE OPERATION

Time of operation The pre-operative routine is continued until the pulse curve has come down to the point where it begins to flatten out and until it does not appear that the pulse rate will fall any lower. Although the fall in the basal metabolic rate usually parallels the pulse curve, it must be remembered that the former is merely a laboratory procedure and the latter is a sound clinical test which represents the response of the organism as a whole to changes in the severity of the hyperthyroidism. It is this response and not merely the basal metabolic rate that affords the best clinical index of a remission of hyperthyroidism. When the pulse curve has fallen nearly to the base line, when the weight curve shows a consistent rise, and when the clinical appearance of the patient indicates that she has developed as much emotional stability as can be expected, then the time for operation has arrived. Even if the basal metabolic rate is high, the patient is in as good a condition for operation as she will ever be.

Place of operation When a nervous patient is to have an operation under local anesthesia supplemented with nitrous oxide analgesia, it is of definite advantage to carry out the procedure in the patient's room without moving her from her bed. The disturbances associated with transferring the patient from bed to stretcher and stretcher to operating table, and the inherent fear of the operating room may produce psychic trauma, destroy the analgesic state induced by pre-operative hypnotics, and render the patient so nervous and apprehensive that any sensation is interpreted as pain.

If, however, an anesthetist with whom the patient is already acquainted brings in the familiar gas machine and starts administering oxygen just as she has on previous occasions, if the patient is lying undisturbed in her own bed in her own room, if her mind is distracted from the surgical procedure by a combination of light gas oxygen analgesia and conversation especially designed to focus her attention away from the operation, then it is relatively simple to infiltrate the neck with novocain and remove the thyroid often without the patient being aware that the operation is going on. Thyroidectomy for hyperthyroidism is therefore performed in the patient's room without moving her from her bed.

Anesthesia In elderly patients pneumonia is the commonest cause of death after thyroidectomy. General anesthetics tend to depress respiration, to abolish the cough reflex, and to act as a protoplasmic depressant, lowering the patient's resistance to intercurrent infection,

notably pneumonia. In the aged, the depression incident to a basal or general anesthesia may be the deciding factor as to whether or not a fatal pneumonia will develop. Therefore, in the majority of patients over 45 years of age, no basal anesthetic is given and the operation is performed under local anesthesia supplemented with nitrous oxide analgesia.

In a strong young individual, the margin of safety is so great that the depression induced by a basal anesthetic can be disregarded, yet even in younger patients profound narcosis is undesirable, whether it be induced by inhalation anesthesia or by any of the various drugs used as basal anesthetics. Occasionally, in the course of a thyroidectomy, particularly when it is necessary to deliver a retrotracheal extension of the gland, a stridor may develop even in the absence of injury to the recurrent laryngeal nerves. When this occurs, a patient who is conscious is better able to maintain respiratory exchange than is a patient who is under deep anesthesia. The same principle applies as in the surgical treatment of a deep abscess or cellulitis of the neck, in which case it is widely recognized that a general anesthetic may result in fatal respiratory obstruction. Emergency tracheotomies will be avoided by performing thyroidectomies under local anesthesia supplemented in good risk patients by no more than a light basal analgesia.

For many years Dr. Crile, Sr., has judged the condition of the patient during the operation by her morale during the procedure and by her responsiveness to conversation with the anesthetist. Especially in older patients, the first sign of an unfavorable reaction will be the inability of the patient to think clearly and react. This sign usually precedes the rise of pulse rate by some minutes and affords a good indication for stopping the operation after the removal of a single lobe. A valuable indication of an unfavorable reaction must therefore be sacrificed if a general anesthetic is given. And finally it is of value after the removal of the first lobe to hear the patient talk and to assure oneself of the integrity of the recurrent laryngeal nerves.

Patients in the younger age groups are not susceptible to postoperative pneumonia. In these cases, the greatest danger is from thyroid crisis, and the sedation afforded by a basal anesthetic of sufficient depth to afford amnesia without excessive depression is extremely valuable.

A patient with a low or with a normal basal metabolic rate will be analgesic (although generally not completely unconscious) after the administration of avertin in a dosage of 50 or 60

milligrams per kilogram of body weight, whereas a patient with a basal metabolic rate of plus 40 per cent will require 70 milligrams per kilogram for a similar effect and patients with higher metabolic rates may require even larger doses. If a middle ground is to be reached between absence of analgesic effect on the one hand and undue depression on the other, the amount of anesthetic to be given should be varied in accordance with the basal metabolic rate. In our experience, it has been possible to obtain this middle ground of analgesia in 94 per cent of the patients receiving basal anesthetics. In this group, the patients had no unpleasant recollections of the operation and yet were able to talk throughout the procedure.

Type of operation. Lahey (8), Mayo, Dinsmore, Dr. Crile, Sr., and others have emphasized the advisability of stage operations in cases in which the risk of thyroidectomy is great. We are in complete accord with this preference for stage operations in bad risk patients and at the present time are performing pole ligations on 1 per cent of the patients with hyperthyroidism and lobectomies on 12 per cent, usually reserving these procedures for patients in the older age groups.

In this series, although there have been 49 deaths following the first stage of the operation, there has never been a fatality following the second lobectomy for hyperthyroidism when the patient has been sent home between stages.

It has been said by proponents of a one stage procedure that dividing the operation merely subjects the patient to the risk of two surgical procedures instead of one. In view of the fact that the risk following a second lobectomy is so slight as to be negligible, these arguments would appear to be unsound. We are convinced that many patients who barely survived a single lobectomy would have expired if the entire operation had been carried out at the time of the first stage. Occasionally, when the reaction to the first stage has been minimal, it is entirely safe to reopen the incision at the end of 2 or 3 days and remove the other lobe, thus saving the patient the expense and inconvenience of a second period of hospitalization.

In desperate cases, ligations of the superior poles done separately a week apart are followed by a course of roentgen therapy before the patient is discharged from the hospital. I believe that in some instances more striking remissions are obtained by ligation and roentgen treatment than could be obtained independently by either agent. I wish to emphasize at this point that roentgen therapy is not recommended in the treatment of

before the patient was admitted to the hospital

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Psychological considerations The sudden appearance of a stranger with an unfamiliar apparatus such as the gas machine may, in itself, be sufficient to precipitate a severe emotional reaction in a patient of unstable makeup. We have seen a fatal thyroid crisis initiated by draping a patient for operation and administering the lightest gas oxygen analgesia although the operation was cancelled because of the patient's emotional reaction (Fig. 2). It is therefore advisable in cases in which it is best to avoid basal anesthetics to have the anesthetist visit the patient daily, administer inhalations of oxygen and gain the patient's confidence.

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The oxygen tent is used routinely after operation on bad risk patients. Occasionally the patient will be confused after operation and will awake to find herself enclosed in a tent and may strike at it and exhaust herself in demanding that it be removed. In order to avoid this issue several days before the operation the bad risk patient is placed in the tent for a few minutes so that she can overcome any apprehension that she might have in regard to the tent.

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Time of operation The pre-operative routine is continued until the pulse curve has come down to the point where it begins to flatten out and until it does not appear that the pulse rate will fall any lower. Although the fall in the basal metabolic rate usually parallels the pulse curve it must be remembered that the former is merely a laboratory procedure and the latter is a sound clinical test which represents the response of the organism as a whole to changes in the severity of the hyperthyroidism. It is this response and not merely the basal metabolic rate that affords the best clinical index of a remission of hyperthyroidism. When the pulse curve has fallen nearly to the base line, when the weight curve shows a consistent rise, and when the clinical appearance of the patient indicates that she has developed as much emotional stability as can be expected, then the time for operation has arrived. Even if the basal metabolic rate is high, the patient is in as good a condition for operation as she will ever be.

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Anesthesia In elderly patients pneumonia is the commonest cause of death after thyroidectomy. General anesthetics tend to depress respiration, to abolish the cough reflex, and to act as a protoplasmic depressant lowering the patient's resistance to intercurrent infection,

therefore be established and applied to every bad risk case.

In recent years we have recognized an unclassifiable type of fatality in which an old and feeble patient appears to "fade away" as though from a profound metabolic exhaustion. We believe that this "metabolic exhaustion" is a modification of the thyroid reaction dependent on the inability of feeble and aged patients to muster sufficient reserves of strength to give the appearance of thyroid stimulation or even to produce a marked elevation of the temperature. Although a classical thyroid crisis is the immediate cause of death in less than one-fourth of all fatal cases, it is clear that thyroid reactions of lesser intensity predispose not only to the reaction just described but also to cardiac failure and to pneumonia.

Administration of iodine after operation. While we believe that small amounts of iodine should always be continued for at least 2 days after operation, we never have felt that the postoperative use of large doses of iodine exerted any striking effect on the thyroid reaction of a patient who before operation had received full doses of iodine. The action of iodine is not on the tissues of the body or on the thyroid hormone circulating in the blood, but is rather a direct one on the secretory activity of the thyroid gland (6). For this reason, large doses of iodine cannot be expected to produce any further effect on the postoperative reaction of a fully iodized patient. The best we can do is to give the routine small dose of iodine so that at least there will be no exacerbation of symptoms incident to its withdrawal.

Blood transfusion. If anemia is present, the heart is handicapped during the thyroid reaction by the inability of the blood to carry its full quota of oxygen. Although it is often inadvisable to give a transfusion during the height of a thyroid crisis when the slightest reaction to transfusion would tend to elevate a temperature that is already dangerously high, a blood transfusion given *immediately* after operation is a valuable therapeutic measure in the treatment of patients with severe hyperthyroidism or in aged and debilitated patients.

Oxygen tent. For the past 7 years we have made a practice of placing all bad risk patients in the oxygen tent immediately after operation. The oxygen tent is not used for pulmonary complications only, but has been found effective in the treatment of cardiac failure and of uncomplicated thyroid crises. We have repeatedly observed a fall in temperature of from 1 to 3 degrees within 3 hours of the time the patient is placed in the oxygen tent. Whether this effect is the result of

the oxygen, of the refrigerated air of the tent, or a combination of the two factors is not clear. That the temperature of the air undoubtedly plays a part in the control of thyroid crises is indicated by the fact that fatal thyroid crises in this series have been 24 times as frequent in the hot summer months as in the remainder of the year. The refrigerated oxygen tent is therefore placed over the bad risk patient as soon as the operation is completed.

Sedation. Morphine is the most valuable drug for the control of discomfort and restlessness in patients convalescing from thyroidectomy. The tolerance of the patient to morphine varies in direct proportion to the degree of elevation of the basal metabolic rate and patients with high basal metabolic rates, especially when in the height of a thyroid crisis, should be given large doses of morphine (up to $\frac{1}{2}$ grain) at frequent intervals.

Continuous intravenous glucose. Patients with severe hyperthyroidism have exhausted the reserves of glycogen that are normally present in the liver (4). The increased metabolism demands fuel for oxidation. After operation, it is painful to swallow, nausea and vomiting are frequently present, and the patient takes little nourishment. Thus at the time when the caloric demand is highest, the patient's liver is depleted of glycogen and food is not being taken. Unless an adequate caloric intake is promptly restored, the organism must literally oxidize itself in order to provide fuel for the raging metabolism. In patients with severe hyperthyroidism the continuous administration of glucose solution into a vein will prevent this crisis of catabolic processes and minimize the postoperative elevation of pulse rate and temperature.

Forced feeding. It is usually impossible to give intravenously more than 2,000 calories a day in the form of glucose without losing much of the glucose through the kidneys. This is a small part of the total caloric requirement of a patient in thyroid crisis and should be supplemented, when the patient is able to eat, with high caloric, high carbohydrate feedings. If the patient refuses food, feedings can be given through a nasal tube.

Causes of death following thyroidectomy and the individualization of postoperative treatment. It has already been noted that pneumonia, myocardial failure, and thyroid crisis in this order are the commonest causes of death following thyroidectomy. An analysis of the fatalities shows that each cause of death is far more common in certain groups of patients than in others. For example, pneumonia is the most common cause of death following thyroidectomy in pa-

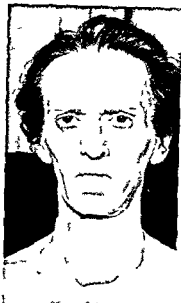


Fig. 3. This patient, a foreign woman 48 years of age, had a pulse rate of 150. The basal metabolic rate was plus 92 per cent and she had lost 46 pounds in weight. Her attitude was emotionalism and inability to understand English rendered her most difficult to manage.

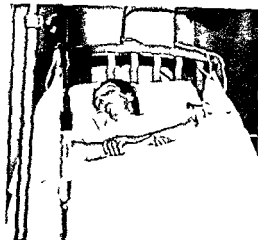


Fig. 4. Exhaustion from long standing hyperthyroidism. A woman 58 years of age, had had hyperthyroidism for 11 years. This was accompanied by auricular fibrillation and loss of 70 pounds in weight. The basal metabolic rate was plus 29 per cent. Thyroid crisis with delirium and a rise in temperature to 102 degrees F. followed falling out of bed during her stay in the hospital preparatory to operation. Note that the facies express exhaustion rather than stimulation and that in spite of the severity of the disease her general appearance is not typical of hyperthyroidism.

hyperthyroidism except as an adjunct to surgery in selected cases involving the greatest operative hazard. Three months after the ligation the patient returns for a lobectomy and is again discharged to return in 4 months for the final lobectomy.

Management between stages of a divided operation. Between stages of a divided operation the patient is given 5 minims of Lugol's solution daily. In the year 1926, following Plummer's discovery of the effects of iodine many of our patients had received iodine for long periods of time before consulting a surgeon. In that year there were 20 postoperative deaths in a series of 1,700 cases, and the case mortality rate including all deaths which took place after operation in the hospital from any cause being 1.2 per cent.

In the same year, 19 deaths occurred at home between the stages of divided operations usually after ligations but occasionally following lobectomies. This gave a mortality rate of 1.1 per cent at home between operations and constituted practically the same death rate as occurred in the hospital. These deaths occurred in patients, the severity of whose hyperthyroidism was masked by iodine administered prior to their

admission. Following operation, the patients were sent home without iodine and the exacerbation of the disease incident to the withdrawal of iodine was greater than the remission induced by operation. The net result was therefore a fatal exacerbation with death resulting from thyroid crisis or from cardiac failure.

Means has shown that iodine exerts a constant effect over a long period of time and that even those patients who seem to be showing the phenomenon of iodine escape will show a greater exacerbation of hyperthyroidism if iodine is withdrawn. We do not therefore consider it safe to withhold iodine between the stages of divided operations unless the patient's progress can be followed closely during the interval.

POSTOPERATIVE CARE

Postoperative routine for bad risk patients. The postoperative thyroid reaction is directly or indirectly responsible for the majority of deaths following operations for hyperthyroidism. Even though we rate pneumonia, cardiac failure and the thyroid crisis in this order as the commonest causes of death, it is clear that in the majority of cases the thyroid reaction is the indirect cause of the fatal complication. A postoperative routine designed to minimize the thyroid reaction should



Fig 5

Fig 5 Diffuse goiter with active hyperthyroidism In this type of case, thyroid crisis is the greatest hazard and a basal anesthesia is of advantage in minimizing the psychic reaction to the operative procedure



Fig 6

Fig 6 Postoperative thyroid reaction in the aged Feeble, elderly patient of the type in whom postoperative



Fig 7

pneumonia is the greatest hazard Age 62 years, pulse, 120, loss of 60 pounds in weight

Fig 7 The same patient as shown in Figure 6 She is alive and well 5 years following a multiple stage operation which was performed under nitrous oxide analgesia and local anesthesia

but if in spite of these measures the temperature should rise to critical levels, the patient, with the skin protected can be literally packed in cracked ice so that more heat is abstracted than can be created Fortunately, this type of reaction is now extremely rare, and in the great majority of cases, 10 grains of aspirin will result in a deferescence of from 1 to 3 degrees in 2 hours

Hyperthyroidism in old age The management of the aged patient in whom pneumonia is the greatest hazard is quite different (Figs 6 and 7) We have seen that sedation and avoidance of psychic disturbances are fundamental principles in the management of severe hyperthyroidism in the young adult But in the aged and also in patients with intrathoracic goiter, we must avoid depression of the respiration, of the cough reflex, or of the internal metabolism of the body because of the danger of inducing a terminal pneumonia Depressant drugs are tolerated well in the young, but easily force the aged below the threshold of resistance to pneumonia Blood transfusion, the oxygen tent, and every resource at our disposal must be utilized to build up the resistance of the aged patient

In the aged it is better to perform the operation under local anesthesia with a minimum of nitrous oxide analgesia Similarly, the use of morphine postoperatively should be limited to the minimum requirements

In old age, the principle of the multiple stage operation should be followed and a trial ligation should be performed if there is any question in the mind of the surgeon as to the ability of the patient to withstand a more extensive operation

Ice bags should be applied only when absolutely necessary so that chilling with its attendant liability to pulmonary complications may be avoided

Occasionally during the postoperative reaction, an elderly patient becomes so feeble that she is unable to raise the mucus which has accumulated in the trachea and bronchi When this occurs, the patient becomes cyanotic, dyspneic, the temperature rises, she becomes more feeble, the attempts to cough become progressively weaker and a fatal bronchopneumonia may develop Atropine and the various expectorant mixtures have not been effective Recently we have adopted the simple expedient of giving the patient $7\frac{1}{2}$ grains of

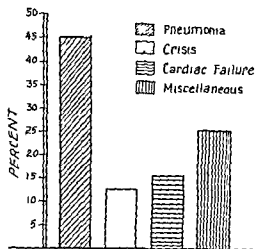


Chart 1 Causes of death following operation on patients with hyperthyroidism complicated by age over 60

tients over 60 years of age and in patients with intrathoracic goiter (Chart 1) and is more common in men than in women. Thyroid crisis on the other hand, is the most common cause of death in patients whose pulse curves are flat in patients who have had psychoses and in patients with excessively high basal metabolic rates (Chart 2). In patients with cardiac complications the most common cause of death is myocardial failure (Chart 3). If the best results are to be obtained the relative susceptibility to the common complications must be recognized and treatment instituted to avert the compli-

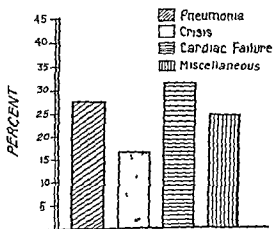


Chart 3 Causes of death following operation on patients with hyperthyroidism complicated by auricular fibrillation, severe myocardial damage, or valvular heart disease

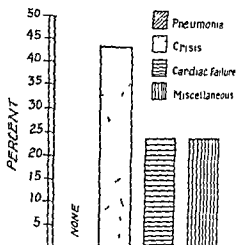


Chart 2 Causes of death following operation on patients with hyperthyroidism complicated by basal metabolic rate of over plus 50 per cent

cation to which the individual is most susceptible.

Postoperative treatment of patients with severe hyperthyroidism. In the younger patients who have a flat pulse curve, an excessively high basal metabolic rate, or in those who have had a psychosis, the greatest danger is from thyroid crisis and our therapeutic measures against thyroid crisis including blood transfusion, a continuous intravenous drip of glucose solution, the oxygen tent, and morphine in doses sufficient to insure comfort and rest, should be used immediately following the operation. Patients with severe hyperthyroidism as Collier has shown lose enormous quantities of water through the skin and it is advisable to give from 4,000 to 6,000 cubic centimeters of 5 per cent glucose solution a day until the patient is eating and drinking well. In this group of cases, especially if the patient is relatively young and otherwise in good condition, a basal anesthesia of avertin is of definite value in controlling the overactive emotional mechanism and minimizing the postoperative reaction (Fig. 5).

A thyroid crisis is a vicious circle of hyperthermia and hypermetabolism in which each Fahrenheit degree of elevation of the temperature results in a 7.2 per cent increase in the metabolism and in the production of heat. Unless the mechanism for the dispersion of heat is accelerated, a further rise of body temperature will ensue. The oxygen tent and ice bags placed on the patient's extremities and about the sides of the body will usually control any tendency to hyperthermia.



Fig 5



Fig 6



Fig 7

Fig 5 Diffuse goiter with active hyperthyroidism In this type of case, thyroid crisis is the greatest hazard and a basal anesthesia is of advantage in minimizing the psychic reaction to the operative procedure

Fig 6 Postoperative thyroid reaction in the aged Feeble, elderly patient of the type in whom postoperative

pneumonia is the greatest hazard Age 62 years, pulse, 120, loss of 60 pounds in weight

Fig 7 The same patient as shown in Figure 6 She is alive and well 5 years following a multiple stage operation which was performed under nitrous oxide analgesia and local anesthesia

but if in spite of these measures the temperature should rise to critical levels, the patient, with the skin protected can be literally packed in cracked ice so that more heat is abstracted than can be created Fortunately, this type of reaction is now extremely rare, and in the great majority of cases, 10 grains of aspirin will result in a deferescence of from 1 to 3 degrees in 2 hours

Hyperthyroidism in old age The management of the aged patient in whom pneumonia is the greatest hazard is quite different (Figs 6 and 7). We have seen that sedation and avoidance of psychic disturbances are fundamental principles in the management of severe hyperthyroidism in the young adult But in the aged and also in patients with intrathoracic goiter, we must avoid depression of the respiration, of the cough reflex, or of the internal metabolism of the body because of the danger of inducing a terminal pneumonia Depressant drugs are tolerated well in the young, but easily force the aged below the threshold of resistance to pneumonia Blood transfusion, the oxygen tent, and every resource at our disposal must be utilized to build up the resistance of the aged patient

In the aged it is better to perform the operation under local anesthesia with a minimum of nitrous oxide analgesia Similarly, the use of morphine postoperatively should be limited to the minimum requirements

In old age, the principle of the multiple stage operation should be followed and a trial ligation should be performed if there is any question in the mind of the surgeon as to the ability of the patient to withstand a more extensive operation

Ice bags should be applied only when absolutely necessary so that chilling with its attendant liability to pulmonary complications may be avoided

Occasionally during the postoperative reaction, an elderly patient becomes so feeble that she is unable to raise the mucus which has accumulated in the trachea and bronchi When this occurs, the patient becomes cyanotic, dyspneic, the temperature rises, she becomes more feeble, the attempts to cough become progressively weaker and a fatal bronchopneumonia may develop Atropine and the various expectorant mixtures have not been effective Recently we have adopted the simple expedient of giving the patient $7\frac{1}{2}$ grains of

caffeine sodium benzoate, withholding sedation periodically elevating the foot of the bed on high shock blocks, and urging the patient to cough while lying prone with the head down at an angle of approximately 30 degrees. After 5 or 10 minutes of postural drainage an astonishing amount of mucus will pour out and the airways will clear up and the temperature and pulse rate will fall promptly.

Hyperthyroidism with cardiac complications
Pre-operative digitalization as has been mentioned previously is of value in those patients who show evidence of severe myocarditis or who have auricular fibrillation or cardiac decompensation. Oxygen therapy is of value in the presence of cardiac complications as is morphine in doses adequate to insure rest. In this way the failing myocardium is strengthened by the digitals, the efficiency of the oxygen-distributing function of the heart is increased by the oxygen tent, and the metabolic demands of the organism as a whole are decreased by the morphine to the point where a balance between oxygen supply and demand is struck and cardiac compensation is restored.

Blood transfusion is contra-indicated in the presence of acute cardiac decompensation and the intravenous administration of fluids should not exceed 3,000 cubic centimeters per day given by the continuous drip method.

SUMMARY

1. The chief factors influencing the risk of thyroidectomy are (a) the age of the patient (b) the condition of the heart (c) the response of the pulse curve to pre-operative treatment and (d) the degree of extension of the goiter into the thorax. The basal metabolic rate, the duration of the disease and the loss of weight are of relatively less prognostic significance.

2. The importance of a high caloric high carbohydrate diet in the pre-operative treatment in severe hyperthyroidism is emphasized.

3. The safe time for operation is best determined by observation of the pulse curve and the weight curve.

4. The advantages of performing the operation in the patient's room instead of moving the patient to the operating room are summarized.

5. A light basal anesthesia with avertin is helpful in younger patients. Elderly or debilitated patients should not be subjected to the depressing effects of either basal anesthetic or of a general anesthesia. A combination of nitrous oxygen analgesia and local anesthetic affords the most satisfactory anesthesia in these cases.

6. The advantages of stage operations in bad risk cases are summarized.

7. All patients between stages of a divided operation should receive small doses of iodine unless they can be kept under close personal observation.

8. Pneumonia, cardiac failure and thyroid crisis in this order are the most common causes of death following thyroidectomy.

9. The use of blood transfusion, the continuous intravenous administration of glucose solution, the oxygen tent, and adequate sedation are the most important points in the post-operative treatment of the bad risk patient. High caloric high carbohydrate feedings should be given.

10. Pneumonia is the most common cause of death following thyroidectomy for hyperthyroidism in patients over 60 years of age and in patients with intrathoracic goiter and especially in men. Specific measures directed against pulmonary complications should be adopted in these cases.

11. In patients who have a flat pulse curve in patients with excessively high basal metabolic rates and in patients in whom a psychosis has been present, thyroid crisis is the most common cause of death and specific measures to avert thyroid crisis should be taken.

12. In patients with organic heart disease, myocardial failure is the most common cause of death. The management of these patients should be individualized to avoid this complication.

13. Postural drainage often relieves the patient of the troublesome mucus which occasionally develops following thyroidectomy.

14. The complications of thyroidectomy for hyperthyroidism are easier to avoid than to treat after they have developed.

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THE TREATMENT OF INFECTIONS OF THE FEMUR WITH MAGGOTS

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IN previous communications the writers have reported the end-results in a series of 44 septic compound fractures of the tibia (5) and of 29 cases of hematogenous osteomyelitis of the tibia (6) which had been treated with maggots and followed up to the time of writing. In both instances about 90 per cent of the patients who could be located for examination showed lesions which had been closed for an average period of 2 years.

The purpose of this paper is to present the end-results of maggot treatment in 29 cases of infections of the femur. The series is comprised of 18 cases of hematogenous osteomyelitis, 8 septic compound fractures, and 3 cases of tuberculosis with chronic secondary infection. Most of the patients have been seen at the Boston City Hospital during the past 7 years. No cases were refused for treatment and none of those treated have been omitted. It has been possible to follow nearly all of the patients up to the time of writing and to obtain final x-ray films shortly prior to June 1, 1937.

The literature of maggot therapy has become so extensive since Baer's papers were published that it cannot be reviewed here. The reader is referred to the bibliography compiled by Robinson (9).

METHODS

The *operative technique* and preliminary treatment in all cases were essentially those described by Orr. There was considerable variation in the amount of bone removed, location of incisions and degree of exposure obtained, due to the fact that the operations prior to maggot therapy were performed by a number of different surgeons.

Maggot therapy was instituted at varying times following the onset as indicated in Table I. The management of wounds under maggot treatment has already been described (5, 6). The femur cases present the special difficulty of maintaining exposure of the bone which can usually be obtained by packing the wound lightly with gauze at each dressing. At times mechanical devices such as self-retaining retractors (3, 11) or the Mosher drain (7) are necessary. Secondary oper-

ations were performed on many cases in order to improve exposure.

The *culture* and *sterilization* of maggots has been described by Robinson (10) whose methods were used in this study. The flies were of the species *Phormia regina* or *Lucilia serricata*.

RESULTS

Detailed data on the series are presented in Table I and summarized in Table II. The cases have been arranged under appropriate headings and numbered arbitrarily in the order in which maggot treatment was begun.

Group 1 Subacute hematogenous osteomyelitis
Of the 8 cases in this group, 6 are closed, 1 has been lost, and 1 is still under treatment. The average time since closure is 4 1/2 years.

The patient who was lost (Case 5) has not been seen since the date of hospital discharge but recent correspondence indicates that closure ultimately occurred and has persisted.

The patient who is still under treatment (Case 8) had a *Streptococcus hemolyticus* osteomyelitis following an infection of the toe in 1935. He was treated for 112 days with maggots and the wound closed on February 14, 1936. The wound remained closed and symptom free except that on 3 subsequent occasions, swelling, redness, and fluctuation developed in the scar over the lateral aspect. Treatment consisted of rest with incision and drainage of the scar. The wound discharged about 40 cubic centimeters of bloody pus at each incision and closed again in 2 to 3 weeks. After the final exacerbation had subsided the patient was readmitted to the hospital on June 28, 1937. A preliminary course of sulfanilamide (80 grains per diem by mouth) was given for 6 days and an operation performed on July 14, 1937. At operation a defect 1 centimeter wide and 7 centimeters long was found in the lateral aspect of the femur. The marrow cavity contained brownish granulations but no pus. The edges of the opening in the bone were freshened with a chisel and the wound packed open widely with vaseline gauze. Cultures were sterile. The patient was discharged July 27, 1937. Wound treated for 14 days with maggots and closed on September 9, 1937. There is every reason to believe that closure will persist.

From the Osteomyelitis Clinic, the Fifth (Harvard) Surgical Service and the Surgical Research Laboratory of the Boston City Hospital.

TABLE I

No	Age	Date of onset	Previous operations	M. grosses 12-1	M. grosses topped	Days treated	Hospital discharge	Result
<i>Subacute Hemogenous Osteomyelitis</i>								
1	13	10-30	3	10-31	2 10-32	125	3 11 32	12-10-32 Closed
2	14	8-5-35	2	10-21 31	3 5 32	95	5 4 32	1 6 32 Closed
3	14	10-6-32	1	10-21 32	2 5 31	9	4 15 31	9-1-32 Closed
4	7	8-20 31		2 10-32	4 1 3	4	5 3 1	2 12 32 Closed
5	14	11-30-30	3	1 21 31	5 19 33	15	7 10-31	Lost
6	14	11 12-3	5	2 6-35	1 3 34	433	4 15 31	5 5 34 Closed
7	14	12 10-32	3	5 7 33	2-14 31	160	7 3 11	10-12-32 Closed
8	25	3 25 35	1	4 12-3	5 1-35	11	6 4 35	Tire time 1
<i>Chronic Hemogenous Osteomyelitis</i>								
9	30	1923	6	11 10-30	11 30-30	70	11-10-30	1 1
10	44	1906	4	3 7 31	3 4 31	1	4 24 3	12-1-31 L 1
11	23	2 10-30	3	1 3 33	2-1 3 3	38	5 15 31	1 8 31 Closed
12	7	6-5-27	5	12-23 31	1 3 31	68	7 17 3	12-11 Closed
13	17	2-9-3		3-18 34	6 5-34	70	4 24-34	5 24 35 Closed
14	60	1885	4	4-10-34	6-30-34	65		Lost
15	35	1900	5	1 14-36	1-29 36	4	2-6-36	Tire time 1
16	37	1900	6	1 15 36	3 4 36	81	2-10-36	Tire time 1
17	3	1 17 33		2-7-36	3 36	6	3 16-36	Treatment
18	14	2-6-7	1	1 10-37	3 3 3	61	3 17 37	Treatment
<i>Tuberculosis with Secondary Infection</i>								
19	34	1888	5	4 1 35	6-36	150	8 16 35	Tire time 1
20	62	1904		14 36	2 27 36	5	5 10-36	10-26 36 Closed
21	42	1896	5	5 16	21 36	10	3 0-36	3 0-36 Closed
<i>Subacute Septic Compound Fractures</i>								
22	61	0-31	1	5 4 31	11 18 31	95	0-4 31	4 3 32 Closed
23	0	4 30	2	11 7 5	28 3	03	0-3	6-14 5 Closed
24	14	7 5 31		1 4 34	4 5 34	79	8 16-31	1 15 31 Closed
				11 0 35	0-5			
25	10	0-5 35		1 36	1 16		1 1 35	5 0 16 Closed
26	34	8 36		1 0-36	3 3 1	9	0-9 36	3 4 10 Amput 1
<i>Chronic Septic Compound Fractures</i>								
27	70	006	0	5 0-9	4 5 1	34	0 1	
				1	0 10		1 0 10	
				4 5 46	0 0 30		1 0-6	1 1
28	03	0-10-8	1	1 0 5	4 31		1 13	11 31 Closed
29	4	191	1	1 2 5	1 1		10	0 36 Closed

All of these patients showed involvement of the lower end of the femur. The organism found was *Staphylococcus aureus* in 7 cases and *Streptococcus*

hemolyticus in 1 case. There was ankylosis of the knee in 1 case due to primary joint involvement. 3 other cases have some limitation of movement.

TABLE II A — SUMMARY OF CASES

	Subacute	Chronic	Tuberculosis	Compound fractures		Total
				Subacute	Chronic	
Number of cases	8	10	3	5	3	20
Closed	6	1	2	4	2	17
Treated	1	4	1	0	0	6
Amputation	0	0	0	1	0	1
Lost	1	3	0	0	0	4
Failure	0	0	0	0	1	1

TABLE II B — DETAILS OF TREATMENT

	Subacute	Chronic	Tuberculosis	Compound fractures	
				Subacute	Chronic
Onset to maggots	96 ds	19 yrs	33 yrs	144 ds	11 yrs
Maggot treatment	169 ds	45 ds	117 ds	69 ds	123 ds
End of treatment to closure	218 ds	271 ds	40 ds	144 ds	46 ds
Total illness	483 ds	203 yrs	333 yrs	356 ds	113 yrs
Time since closure	4 13 yrs	3 53 yrs	1 33 yrs	2 63 yrs	2 73 yrs

tion but not sufficient to interfere with walking. Trauma was noted as an exciting cause in 5 cases and previous infections were recorded in 6 cases.

Group 2 Chronic hematogenous osteomyelitis. Of the 10 cases in this group 3 are closed, 3 refused treatment and are counted as lost, and 4 are still under treatment. The average time since closure is 3 5 years. The 7 unclosed cases in this group may be considered briefly.

Lost cases (Refused treatment.) Case 9 was a man of 30 who had had osteomyelitis for 20 years. This was the first femur which we treated with maggots. The operation which had been performed prior to treatment consisted of the excision of an old scar on the medial aspect of the thigh. Exposure was inadequate but treatment was undertaken in order to determine whether maggots could penetrate deep sinuses. After 20 days the patient refused treatment and left the hospital. Recent communication revealed that the patient still has exacerbations with pain accompanied by discharge from the old sinuses. He is now working in the Middle West.

Case 10 was a Jewish peddler, aged 44 years, who was admitted to this hospital March 2, 1931, giving the history of osteomyelitis of 25 years' duration. An operation had been performed at another hospital about 4 months previously, but



Fig 1, left Case 1 October 7, 1931 Before treatment
Fig 2 April 27, 1937 Four and one-half years after closure

drainage persisted. At operation on March 4, 1931, a sponge was found in the center of the femur completely surrounded by bone and invaded with granulations. This was removed with considerable difficulty. Maggots were placed in the wound 8 days after operation, but the patient refused treatment after 12 days. This was our last contact with the patient. He subsequently left the hospital on April 24, 1931. Spontaneous pathological fracture occurred on October 11, 1931, and the patient returned demanding amputation. This was done on October 12, 1931, and an uneventful recovery resulted.

Case 14 was an American widow of 69 who gave the history of a chronic discharging sinus on the lateral aspect of the thigh for 40 years. Treatment was begun without operation. A soft part sinus was suspected because the roentgenograms showed so little evidence of bone involvement. After 4 weeks the sinus was excised under local anesthesia but the bone was not disturbed. Treatment was continued for another 6 weeks when it became evident that a more extensive operation was necessary. This was refused by the patient, and treatment had to be discontinued. The discharging sinus still persists.

Cases under treatment. Cases 16 and 17 both belong to the group of chronic abscess of the popliteal space without bone involvement. This type of abscess will be described in detail elsewhere. (4) Both patients are now practically well and there has been no evidence of bone infection for over



Fig 3 Case 2 December 3 1937
Before maggot treatment



Fig 4 November 3 1937 Five years
after closure

1 year Closure, however has been so recent that it seems wiser to regard them as still under treatment

Cases 15 and 18 are both long standing cases of chronic osteomyelitis in which operations were performed by others during an acute exacerbation In both instances considerable bone destruction resulted Neither is being treated with maggots at present but it is hoped that by conservative measures ultimate closure will result

All these cases showed involvement of the lower end of femur In so far as could be determined *Staphylococcus aureus* was the original organism in every instance By the time maggot treatment was begun a mixed infection existed Ankylosis resulted in Case 13 due to lack of co operation on the part of the patient and in Case 18 because of spread of infection to the knee joint There is some limitation of motion in Cases 16 and 17 Accurate history of trauma and infection could not be obtained due to the long period of time which had elapsed since onset

Group 3 Tuberculosis with secondary infection Of the 3 cases in this group 2 are closed and 1 is still under treatment

The patient under treatment (Case 19) is a single American woman aged 54 years who developed tuberculosis of the hip in 1888 and was operated upon with the diagnosis of an acute septic hip Secondary infection resulted The hip has closed

for short periods of time but drainage has been persistent for nearly all of the 48 years since the original operation On admission April 11 1935 there were in all 6 draining sinuses located on the anterior posterior and lateral aspects of the thigh Maggots were established in all sinuses and after 6 weeks as radical an excision of the sinus tracts as was anatomically possible was performed Several sequestra were removed from the hip joint After 14 days maggots were reimplanted and continued until January 16 1936 One year later another operation for the obliteration of 2 persistent sinuses was performed At that time it was found to be impossible to remove all the dead and devitalized bone without resecting the head of the femur and giving the patient an unstable leg The sinus tracts removed at both operations were sectioned and proved on microscopic examination to be studded with tubercles The patient is now being treated by other methods but still has 2 small persistent sinuses Her general health has improved greatly There is no pain or discomfort in the leg or hip The prognosis is still in doubt but improvement seems to be progressive

Group 4 Septic compound fractures There are 8 cases in this group of which 5 were treated in the subacute stage and the remaining 3 years after the fracture

Subacute cases Of the 5 subacute case 4 are closed and 1 came to amputation and later died

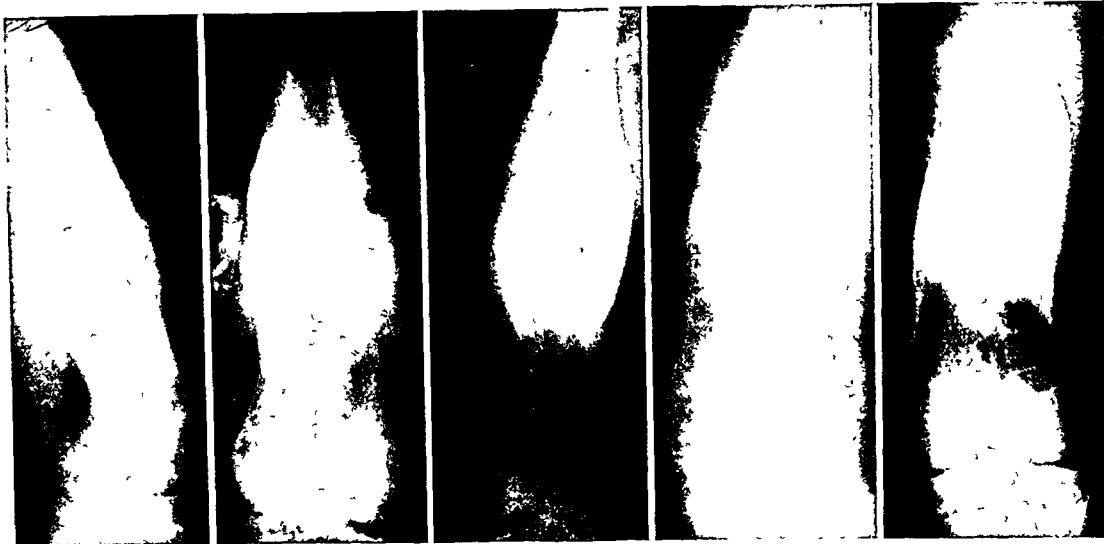


Fig 5

Fig 6

Fig 7

Fig 8

Fig 9

Fig 5 Case 24 December 14, 1933 Before maggot treatment

Fig 6 April 5, 1934 During treatment

Fig 7 June 5, 1935 One sequestrum

Fig 8 October 11, 1935 After operative removal of sequestrum

Fig 9 July 7, 1937 Eighteen months after permanent closure

Amputation (Case 26) An American negro of 34 was struck by the bucket of a steam shovel on February 28, 1936, and sustained a compound fracture of the mid shaft of the femur with avulsion of skin and muscles from the umbilicus to the knee. Maggots were applied on March 9, 1936. The patient was practically moribund but with several transfusions his general condition improved. On February 29, 1936, pneumonia developed and on April 18, 1936, atelectasis of the left lower lobe was recognized. Because of poor general condition and the extent of the tissue destruction mid thigh amputation was performed March 28, 1936, at which time maggots were discontinued. The patient died on September 18, 1936, from miliary tuberculosis due to the lighting up of an old pulmonary lesion by the postoperative pneumonia.

The closed cases in this group have shown persistent closure for an average period of 2.6 years. Ankylosis resulted in Case 22 due to secondary involvement of the knee joint. The site of fracture was as follows: lower end, 2, mid shaft, 2, and upper end, 1.

Chronic cases Of the 3 chronic cases, 2 have been closed for an average period of 2.7 years. The remaining case was abandoned as a failure.

Failure Case 22 was a 70 year old Irish man, who sustained a compound fracture of the mid

thigh in 1906. Drainage persisted from the onset, the knee joint was ankylosed, and the patient was never able to work. On his first admission for maggot treatment in 1931 it seemed possible that closure might result. The cavity was not skin grafted at the time although it had become covered with healthy granulation tissue. After discharge from the hospital the patient disappeared for 4 years. On his return the condition was much worse. Several operations were performed and the lesion treated with maggots for many months. The wound persistently showed areas of bare bone which were removed bit by bit with a chisel without anesthesia. Molecular death of bone continued and the case was finally given up as hopeless because of age and also because of the feeling that there was not enough blood supply left in the femur to support granulation tissue.

In the entire series as summarized in Table II there are 17 closed lesions, 6 are under treatment, 4 have been lost, 1 was amputated, and 1 was given up as a failure. If the cases which are lost are excluded, the percentage of good results is 68, if those still under treatment are also excluded this percentage is raised to 89.

EVALUATION OF RESULTS

The most conspicuous fact brought out by the results is that cases in which treatment was begun



Fig 10

Fig 11

Fig 12

Fig 10 Case 25, January 4 1936 Before maggot treatment

Fig 11 May 13 1938 At time of closure

Fig 12 February 25 1938 Twenty-one months after closure

in the subacute stage of the condition show a high percentage of successes both in the hematogenous osteomyelitis and the septic compound fracture groups. In the hematogenous osteomyelitis cases closure of the wound occurred in a little more than a year and has persisted for an average period of 4 1 years. X ray studies show relatively normal bony structure without evidence of residual infection so that it is reasonable to suppose that closure will continue. The cases of septic compound fracture which were treated early closed in an average period of a little less than a year and have remained healed for 2 6 years. As was pointed out elsewhere (5), when a septic compound fracture heals it stays healed so that no future trouble is anticipated with this group.

The chronic cases of bone infections are of 2 types: those that progress steadily to closure and those which do not respond readily to treatment. The latter group is by far the more important since it requires all of the ingenuity at one's command to attain ultimate healing. The possibility of chronic sinus tract infection not related to bone must always be considered and excluded by preoperative investigation (4).

In the 10 cases of chronic hematogenous osteomyelitis presented only 3 have been closed for any period of time although 2 others have recently

closed. Three refused treatment after a short period of time and can hardly be regarded as failures. The 2 remaining cases which are still under treatment resulted from injudicious operative procedures and are of the character which would defy any method of treatment. The difficulty with chronic cases lies in the fact that there is frequently very little blood supply in the bone due to repeated operations and prolonged sepsis. In some instances it is necessary to perform plastic operations in order to bring some new blood supply to the devitalized bone.

The chief advantage of the use of maggots lies in their ability to remove necrotic material rapidly, diminish sepsis and stimulate the growth of good granulations, all these seem to produce a higher percentage of persistently closed lesions than result from the usual methods of treatment. In previous communications (2, 9) other advantages of maggot therapy have been discussed. Briefly noted they are: clinical improvement of patient (temperature, pulse rate, blood regeneration), continuous nature of the treatment, uncovering of hidden sequestra, reduction in nursing care, and shortening of the period of disability.

The disadvantages of maggot treatment in osteomyelitis of the femur are: expense, time consumed, pain and inaccessibility of bone.

The expense is not as great as would be supposed when consideration is taken of the fact that the period of treatment is only a small fraction of the total time consumed. It is admitted that the time required from the beginning of maggot treatment to closure is long. However, the same objection can be raised to any method of therapy applied to the femur. The most important consideration is to obtain a closed lesion which does not recur. Pain is relatively unimportant because it is seldom pronounced in deep wounds. Accessibility is the greatest mechanical problem in using maggots and at times it is necessary to make special provision for exteriorizing the lesion by the use of retractors or operatively by sewing skin, fascia and periosteum together.

In order to evaluate this study an effort was made to compare the results with those obtained by other methods of treatment. Unfortunately there are no papers available which give data comparable to those presented here. In most instances the patients were not followed for any considerable period of time beyond hospitalization and it is difficult to determine how long treatment was continued. From the reports in the literature one gains the impression that infection of the femur is a time consuming condition of questionable prognosis. However, it is doubtful whether there are

any cases of osteomyelitis of the femur which cannot ultimately be closed, provided that the patient is willing to take the time and the surgeon is willing to study the situation with consistent patience and conservatism

CONCLUSIONS

1 The end-results of maggot treatment of infections of the femur compare favorably with those obtained in the treatment of such lesions by any other method

2 Maggots yield satisfactory results provided good exposure of the bone is obtained by operation and is maintained during the entire course of treatment

The writers are indebted to the following surgeons of the Boston City Hospital staff for referring cases Drs F J Cotton, Horace Binney, I J Walker, A R Kimpton, R C Cochrane, O J Hermann, Somers Fraser, J H Shortell, W R Morrison, J H Burnett and T H Peterson

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SPLENIC VEIN THROMBOSIS FOLLOWING SPLENECTOMY

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WHILE a number of articles appear in the literature concerning thrombosis of the splenic and portal veins as the main etiologic factor in Banti's disease, first demonstrated in 1904 by Dock and Warthin, thrombosis of the splenic and portal veins as a fatal complication of splenectomy has received much less attention. The early articles occasionally mention it and there are a few articles in recent years which discuss it in a little more detail. Most of these, however, concern thrombosis following splenectomy for splenic anemia or Banti's disease.

It is our purpose to review the main articles on this subject and to report a case of hemolytic icterus with this complication following an emergency splenectomy during a hemoclastic crisis. We have been unable to find any other reports of cases of hemolytic jaundice which have developed portal and splenic vein thrombosis following splenectomy.

REVIEW OF LITERATURE

Bessel Hagen in 1900 gave a complete review of all splenectomies up to that time. Johnstone in 1908 reviewed all the cases from 1900 to 1908 and added them to those of Bessel Hagen, making a total of 708 splenectomies with a mortality of 194 cases, or 27.4 per cent. These authors did not give the causes of death and did not refer to thrombosis following operation.

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remained normal or slightly increased. The thrombocythemic group consisted of 4 cases in which the platelet count was normal or increased. All of them had postoperative complications, such as thrombosis of the peripheral veins and of the abdominal veins. The cause of death in one of them was widespread thrombosis of the portal system. This was not necessarily soon after splenectomy but occurred within a year of the operation.

In discussing the results of splenectomy at the Mayo Clinic, Giffin in 1927 stated there was a great increase in the number of platelets and modification of the various factors of coagulation in cases of hemorrhagic purpura. Regarding Banti's disease he also said, "Operative deaths have been due chiefly to hemorrhage, pneumonia, pulmonary embolism, and portal thrombosis." He reported 123 cases with 15 hospital deaths, a mortality of 12.19 per cent. Splenectomy in 27 cases of chronic septic splenomegaly resulted in 7 hospital deaths. He commented, "The majority of hospital deaths were due to portal thrombosis." Ten splenectomies for syphilitic splenomegaly resulted in 1 death in the hospital and 2 subsequently, 1 patient dying 6 weeks after operation from portal thrombosis. In speaking of 81 cases of hemolytic jaundice there were no hospital deaths attributed to thrombosis.

This subject was further discussed by Evans in 1929. He reported 19 cases of Banti's disease and confirmed the opinions of Rosenthal, Kaznelson, and W. J. Mayo that the number of platelets were important in prognosis following splenectomy. If they were high he advised against splenectomy unless the case was otherwise hopeless. One of these patients, who was in the thrombocythemic group, died of mesenteric thrombosis following splenectomy.

Vincent and Hanrahan, while discussing splenectomy in Lewis' *Practice of Surgery*, made the following statement: "The most serious complications are secondary hemorrhage, pneumonia, and the thrombophlebitis of the veins of the portal system. Thrombosis of the portal system is a grave but fortunately not a very common complication, which follows splenectomy, however, more often than any other abdominal operation. The cause is obscure. It may be due to extension upward of a blood clot in the splenic vein furthered, possibly, by a marked increase in blood platelets resulting from removal of the spleen or by thrombophlebitis of the veins of the portal system that existed prior to the operation. The condition is difficult to recognize in the earlier stages. Fever and a high white count combined with abdominal

pain and any disturbance of the bowel movements are suggestive signs. A patient of the writers' with splenic anemia developed symptoms of intestinal obstruction and died the third week after splenectomy. Autopsy showed thrombosis of the splenic and portal veins and a retrograde thrombosis of the superior mesenteric vein with beginning gangrene of a loop of the small intestine."

Walton, writing in the same year, reported 7 splenectomies with 3 operative deaths, 1 of these being due to thrombosis of the portal vein. In discussing the technique of splenectomy, Walton warned, "If the blood platelet count is approximately normal, special attempts should be made to prevent postoperative thrombosis. Citrates may be administered, and early movements should be enforced in the limbs."

Kelly, also in 1929, reported the case of a child, aged 11, with numerous hemorrhages. The chart showed a rise of platelets from 400,000 to 1,000,000 about 10 to 12 days following splenectomy, then a decrease to about 500,000 by the twenty-fifth postoperative day. Another case, a woman aged 63, also in which the diagnosis was not given, showed a great increase in platelets following splenectomy which was still continuing 2 months later. On the seventh and fourteenth days there were thromboses in the veins of the leg. He declared "We believe that postoperative thrombosis is generally, but not invariably, associated with a thrombocytosis. Splenectomy is a safe operation if the thrombocyte count is below 200,000, but is a dangerous one when the thrombocyte count approaches 1,000,000. The patient then runs the risk of thrombosis in the portal and mesenteric veins."

Bryce, in 1932, stated "Surgeons now generally recognize the necessity for taking into account the platelet content of the blood when deciding for or against removal of the spleen. Any operation or trauma will lead to a temporary increase in the count." He showed that fatal thrombosis could occur after splenectomy even with a low platelet count. He cited a case in a woman, aged 32 years, who had ascites, hematemesis, and splenomegaly. On admission her erythrocytes were 1,110,000, leucocytes 13,000, and color index 0.68. The platelets were scanty. After a transfusion the blood count was slightly increased, the platelets were 38,000. She was given another transfusion and the next day splenectomy was done. The spleen was found to be considerably enlarged. A fine hepatic cirrhosis and a good deal of ascitic fluid were found. The patient died 10 days later after a severe hematemesis. No thrombocyte count was given after the operation. Postmortem

SPLenic VEIN THROMBOSIS FOLLOWING SPLENECTOMY

HERBERT H DAVIS, M D FACS and JOHN C SHARPE M D Omaha Nebraska

WHILE a number of articles appear in the literature concerning thrombosis of the splenic and portal veins as the main etiologic factor in Banti's disease first demonstrated in 1904 by Dock and Warthin, thrombosis of the splenic and portal veins as a fatal complication of splenectomy has received much less attention. The early articles occasionally mention it and there are a few articles in recent years which discuss it in a little more detail. Most of these, however, concern thrombosis following splenectomy for splenic anemia or Banti's disease.

It is our purpose to review the main articles on this subject and to report a case of hemolytic icterus with this complication following an emergency splenectomy during a hemoclastic crisis. We have been unable to find any other reports of cases of hemolytic jaundice which have developed portal and splenic vein thrombosis following splenectomy.

REVIEW OF LITERATURE

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Rousselot in 1936 did not agree with Rosenthal regarding the danger of thrombosis after splenectomy in the thrombocythemic form of Banti's disease. Of 31 cases of splenectomy for Banti's disease, in 16 of which an obstructive factor was found in the splenic vein at operation, only 1 developed this complication.

Thompson and associates, reporting from the spleen clinic at the Presbyterian Hospital in New York in 1937, made careful studies of splenic vein pressures in Banti's disease in 15 cases. At operation a needle of the venous pressure apparatus was inserted into the splenic vein after delivery of the spleen and before ligation of any of the larger splenic vessels. They found the splenic vein pressure in this disease to vary from 250 to 500 millimeters of water. They used 3 cases of hemolytic jaundice as controls in which the pressures varied from 105 to 125 millimeters of water. They concluded that this back-pressure in the splenic vein was probably an important factor in accounting for the frequent complication of portal thrombosis in Banti's disease.

REPORT OF CASE

E. M., aged 61 years, male, had had symptoms of hemolytic icterus for the past 5 years. A younger brother had also been jaundiced. Six months ago splenectomy had been advised but the patient refused. At that time his hemoglobin was 57 per cent, erythrocytes 2,860,000 per cubic millimeter, and leucocytes 3,200. The red blood cells showed marked achromia with anisocytosis and poikilocytosis with a shift toward the macrocytic side, polychromatophilia and nucleated red cells (5 per 100 white cells). No spherocytes were noted. The mean corpuscular volume was 124 cubic microns, the mean corpuscular hemoglobin 32.4 micromicrograms, and the mean corpuscular hemoglobin concentration 24 per cent. The reticulocytes varied from 10 to 3 per cent to 14.3 per cent. The fragility of the red cells to hypotonic salt solution showed beginning hemolysis at 0.42 and complete at 0.32 (normal control 0.44 to 0.32). The platelets were 230,000, the bleeding and clotting time normal with firm and rapid retraction of the clot. The serum bilirubin was 17 milligrams per liter. The basal metabolism was minus 8 per cent. A bone marrow biopsy taken from the sternum showed marked hyperplasia of the erythropoietic tissue.

For 6 weeks previous to his second admission to the hospital the symptoms of weakness, dyspnea, palpitation on exertion, dizziness, and increased yellow pallor had been considerably worse. The spleen was enlarged to 9 millimeters below the left costal margin.

The blood count revealed that the hemoglobin had decreased to 25 per cent, erythrocytes to 1,000,000, and leucocytes to 1,400 with the same differential formula. The fragility of the red cells remained normal, but the reticulocytes had increased to 37.5 per cent and quantitative Van den Bergh test to 68 milligrams per liter. The icterus index was 35 units.

Following 2 blood transfusions he had a typical hemolytic crisis with abdominal pain, marked increase of jaundice, and tenderness over the spleen. The anemia increased. Again 2 transfusions were given on alternate days,

but the blood did not respond. The hemoglobin decreased to 16 per cent and the erythrocytes to 510,000 per cubic millimeter. The leucocytes were 2,000 per cubic millimeter.

In view of the severity of the crisis, emergency splenectomy was performed on October 27, 1937. Cyclopropane anesthesia was used. The spleen as first seen measured 25 by 15 by 8 centimeters. There was a marked recent perisplenitis, the omentum being wrapped about the inferior half of the spleen. The superior part of the spleen had many recent adhesions to the diaphragm, which were easily loosened with the operator's hand. The pedicle was ligated in sections, then cut across and the spleen was removed. At no time was a clamp applied to the vessels of the pedicle. There was practically no loss of blood at the operation. The wound was closed. During the operative procedure the erythrocytes rose to 1,550,000, hemoglobin to 32 per cent, and leucocytes to 5,500 as the result of the autotransfusion typically seen in these cases.

During the first 48 hours after operation the patient's general condition was good and the jaundice noticeably lessened. He was given adequate parenteral fluids and a blood transfusion of 500 cubic centimeters immediately following operation and on each of the 2 succeeding days. On the third postoperative day the hemoglobin had further increased to 41 per cent, the red cells to 2,210,000 and the white cells to 3,800. The jaundice had almost entirely disappeared. At this time the temperature was 103 degrees, the pulse 110, and the respiration was 35 associated with increasing abdominal distention. A large amount of clear serous fluid drained freely from the surgical wound through which a small tag of omentum had appeared. Signs of free fluid in the abdomen became evident. The patient died the morning of the fifth postoperative day, with increasing ascites and coma.

Autopsy revealed ascites and a recent thrombosis of the splenic vein extending from the site of ligation into the portal vein including the intrahepatic branches, especially of the right lobe of the liver. The thrombosis in the portal vein had not extended into the mesenteric veins. There was also thrombosis in the distal half of the splenic artery. The gall bladder and common duct contained very small concretions measuring from 0.5 to 1.5 millimeters in diameter. The liver weighed 880 grams and extended 5 centimeters below the zyphoid process. The heart was essentially negative with no antemortem thrombi present. The left pleural cavity contained about 100 cubic centimeters of serous fluid while the right pleural cavity had no excess fluid. There were no antemortem thrombi in the pulmonary artery. The other structures were essentially normal.

Portal thrombosis in this case was probably caused by a combination of factors, such as the blood transfusions, the possible increased elements in the splenic vein due to the marked blood destruction in the spleen during an hemolytic crisis, the impaired circulation in a very ill patient with severe anemia, etc. It is advised that no blood transfusions be given before operation in cases of hemolytic jaundice (16).

CONCLUSIONS

1. The first case of hemolytic jaundice with splenic and portal vein thrombosis following splenectomy is reported.

2. Splenic vein thrombosis as a primary cause of Banti's disease or as a secondary fatal compli-



Fig. 1 Thrombosis of splenic vein



Fig. 2 Thrombosis in intrahepatic branches of portal vein

examination showed the splenic vein to be enlarged almost to the size of the inferior vena cava. It contained a massive friable dark clot from the site of ligature to the junction with the portal vein. The vein's wall was normal. The portal vein was also partially occluded.

Bryce reported another case with normal preoperative platelet count and the previous occurrence of saphenous vein thrombosis in which splenectomy was performed but patient did not develop this complication. He suggested that in these cases postoperative thrombosis of the splenic vein was rendered less likely if surgical interference was limited only to ligature of the splenic artery.

In 1935 a very interesting article appeared in the French literature. Schwedsky and Bratzel stated that thrombosis of the vessels was one of the most frequent complications of splenectomy. As authority for this they gave Rosenthal, Graham and Gregoire. They also stated that numerous researches of physiologists and clinicians had confirmed in an incontestable manner that after splenectomy there was considerable increase of the morphologic elements of the peripheral blood. For this they cited Port and Akvama, Wahlig, Kuentzen, Ascher, Dubois, Aubertin, Stradomsky, Beresov, etc. This increase was accompanied by a corresponding hyperplasia of the reticulo-endothelial tissue. They cited for this Latanabe and Antschkof. They continued that authors had almost unanimously agreed that there was an increase of blood fibrogen and globulin after splenectomy. To prove this they quoted Zurgens, Tautwein, Wahlig, Derevenko, Hey and Clarg, Starlinger, Schedrovitsky, etc. Schweisky and Bratzel performed splenectomies on 5 dogs. Following operation there was a total increase in the hemoglobin, erythrocytes and platelets. The fibrogen and platelets remained elevated longest of all

the elements of the blood. The coagulation time of the blood was also shortened and returned to normal on the fifteenth to nineteenth day. They stated that the facts of their experiments had been confirmed by Dubois, Ascher, Sollberger, Jamamoto, etc.

The second article in the French literature was by Gregoire who demonstrated that pylethrombosis was not the consequence of splenectomy, as is often said, but was made by the same malady that caused splenomegaly. In other words the pylethrombosis was the result of the malady and not of its treatment. He denied the statement in the previous article (Schwedsky and Bratzel) that it was a frequent complication. He stated that the results of splenectomy for hemolytic icterus were remarkable and pointed out that there had not been published a single example of pylethrombosis following splenectomy practiced for hemolytic jaundice. In a series of 338 splenectomies performed for this disease by Patel, Perberton and by Santy and Gregoire there were 23 deaths but not a single one of the deaths was due to pylethrombosis. However he stated that phlebitis of the portal system (and of this system alone) was an extremely frequent accident in splenectomies for chronic splenomegaly. He was of the opinion that the portal thrombosis was a primary condition and following splenectomy there was produced a rapid extension of the thrombotic process which had been in existence for a long time and that the blood changes shown by Schwedsky and Bratzel after splenectomies in dogs were sufficient to provoke thrombosis. He admitted however that they might predispose to that complication and that after the disease had already produced changes in the portal vessel walls these added changes of the blood might cause thrombosis. He also quoted a series of 31 splenectomies done on adults by Kayser which resulted in 16 deaths. Eight or so per cent of these were due to portal thrombosis.

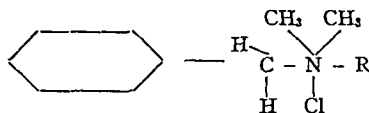
THE USE OF A MIXTURE OF COCONUT OIL DERIVATIVES AS A BACTERICIDE IN THE OPERATING ROOM

CARL W. WALTER, M.D., Boston, Massachusetts

THE pre-operative preparation of the skin requires a germicide with cleansing properties, power of penetration, and good skin tolerance in addition to bacteriologic superiority. A new bactericide (10) must possess these inherent advantages as well as germicidal power to justify its use in the operating room. Detergent action is necessary to remove dirt, skin fats, desquamating epithelium, and superficial bacteria and thus expose the underlying skin and bacteria to the action of the germicide. Power of penetration is essential to insure permeation of the interstices of the skin and to permit the destruction of bacteria not removed by the cleansing. Good skin tolerance permits such thorough cleansing and disinfection without irritation, so that sterile dressings and adhesive plaster can be applied without provoking a rash. Rough skin, brittle finger nails, or dermatitis must not result from repeated scrubbing and prolonged contact with the bactericide. In addition, the ideal bactericide should not stain or impart a lingering odor. The usual requisites for a bactericide, destruction of vegetative bacteria without undue injury to tissues or systemic toxicity, must be fulfilled. A study of a group of coconut oil derivatives, which was made under conditions of actual use, revealed several properties in addition to bactericidal potency which warrant the use of this new bactericide in the operating room.

The bactericidal activity of coconut oil radicals has long been recognized. Coconut oil soaps have been shown to possess germicidal power, whereas other soaps had little or no destructive effect on bacteria (7, 8, 12, 13, 14). The substitution of coconut oil for the saponifying base in the compound solution of cresol increased the phenol coefficient of that solution 50 to 100 per cent (1). Other oils had no appreciable effect. This intrinsic bactericidal activity of the coconut oil radicals has been enhanced by their incorporation into benzyl-ammonium chloride compounds, irritative properties characteristic of the coconut oils have been mitigated.

The bactericidal efficiency of the high molecular alkyl-dimethyl-benzyl-ammonium chlorides¹ (herein termed "the compound") has been established by *in vitro* experiments reported from independent laboratories (2, 4, 5, 9). These non-metallic, organic compounds have a chemical structure illustrated below (3), where R represents one of a mixture of alkyl radicals, ranging from C_8H_{17} to $C_{18}H_{37}$, derived in constant proportion from the fatty acids of coconut oil.



The compounds are soluble in water, acetone and alcohol, imparting an odor of "eau de cologne" to the solution. The aqueous solution is a stable, colorless, saponaceous, alkaline solution, which has an acrid taste. When diluted for topical application, the aqueous solution possesses wetting, detergent, keratolytic, emulsifying, and emollient properties. The surface tension of a 1:1000 dilution is low, 37.4 dynes/cm at 25°C (6).

This unusual combination of properties can be demonstrated readily. The cleansing and wetting action is evident by contrasting the effect of washing off the grime which accumulates on the fingers while handling dusty books, first in tap water, then in a 1:1000 aqueous solution of the compound. The whorls of detritus removed during the pre-operative preparation of the skin illustrate the keratolytic properties. A milky emulsion is readily obtained by shaking human fat, warmed to body temperature, in 1:1000 aqueous solution of the compound. Dilute solutions have an emollient action on the skin which can be exhibited by wearing a dry glove on one hand and a glove wet with 1:5000 solution on the other. The satiny smoothness of the wet hand persists for several hours after thorough drying of the skin.

Experiments intended to demonstrate systemic toxicity were conducted on guinea pigs. All the pigs were fed a standard diet consisting of purina rabbit chow *ad lib*, supplemented with greens.

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¹Alba Pharmaceutical Company, Inc., New York.

cation following splenectomy in cases of Banti's disease and chronic splenomegaly is a fairly common occurrence. High preoperative platelet counts apparently increase the risk of this complication.

3. The possible causes, the rate of incidence and the preventive measures of this complication are reviewed.

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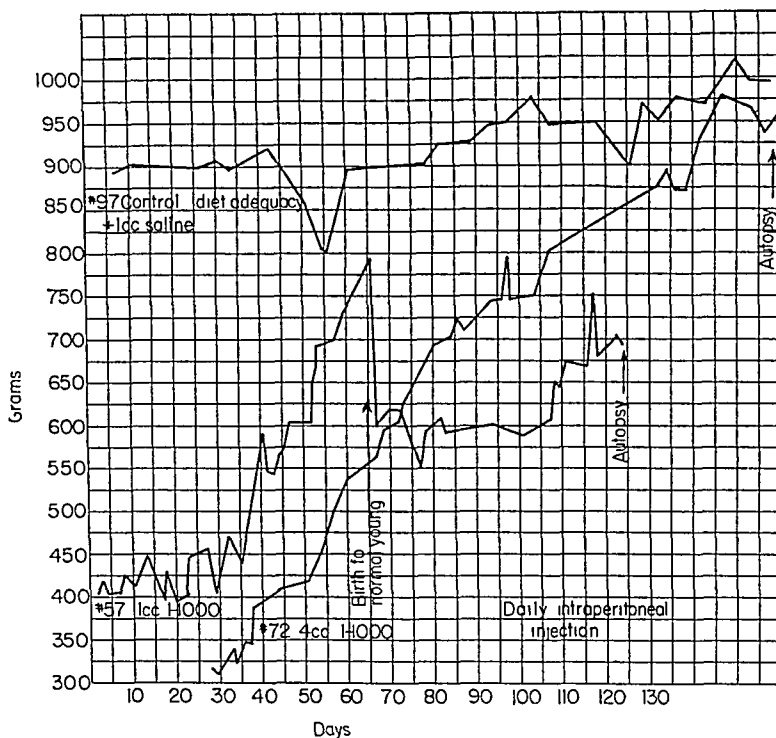


Chart 1 B Daily intraperitoneal injections of dilute aqueous solutions did not interfere with normal development Pig No 57 bred normal young while receiving the injections

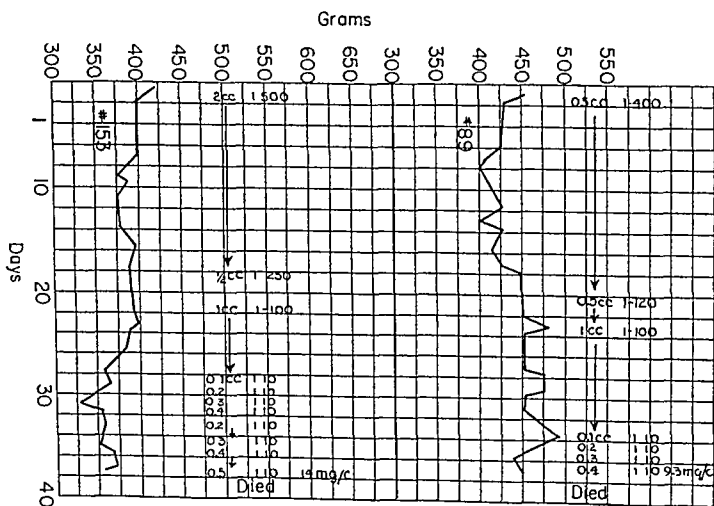


Chart 1 C Daily injections of increasing concentration produced death only when 10 times the minimal lethal single dose was given

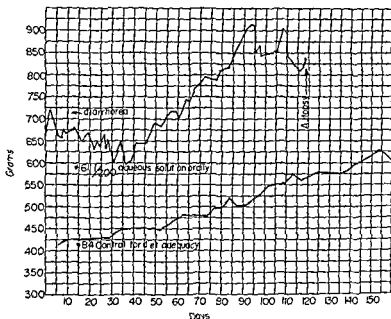


Chart 1A Prolonged oral administration of potable solutions was well tolerated

thrice weekly as a source of vitamin C. Fresh water was constantly available to all but one group.

Various aqueous dilutions of the compound were provided as a substitute for water in this group to determine the effect of prolonged oral administration. Following an initial drop in weight, presumably due to failure to drink and transient diarrhea, the guinea pigs gained weight and showed no abnormality after 3 months (Chart 1A) when tissues were taken for histologic examination.

Daily intraperitoneal injections of dilute aqueous solutions of the compound were given to reveal evidence of cumulative toxic effects. The pigs gained weight and continued in apparent good health. One female gravid at the onset delivered dead embryos after several injections but subsequently bred a litter of two healthy young (Chart 1B). Autopsy after daily injections for 3 months revealed no gross pathology other than scattered areas of thickening and scarification of the abdominal parietes.

Single large doses of the compound were injected intraperitoneally to determine the minimal lethal dose. Death occurred within 24 hours when 2 milligrams per 100 grams body weight were administered as a 1:1000 solution or when

1 milligram per 100 grams body weight was injected as a 10 per cent solution. Autopsy revealed no gross abnormalities other than diffuse peritoneal inflammation.

Because some animals seemed to develop a tolerance for the drug, daily injections of dilute aqueous solution of the compound were given for a brief interval preceding a series of increasingly large doses of the 10 per cent solution continued until death occurred. Several of this group showed sloughing areas in the abdominal wall where some of the concentrate had been injected into the deeper tissues. Death occurred in those which did not develop sloughs only after repeated daily injections of 10 per cent solution many times the minimal lethal dose (Chart 1C). These animals showed no symptoms other than anorexia and diarrhea. Autopsy revealed adhesions and fibrinous exudate in the peritoneal cavity.

Histological examination of sections of the liver, kidneys, and intestines of the animal used in the toxicity experiments revealed no changes which could be interpreted as manifestations of the systemic toxicity of the compounds (11). The injection of concentrated solutions caused an acute inflammatory reaction in the peritoneum. Local necrosis and sloughing occurred where the concentrated compound was injected into the tissues.

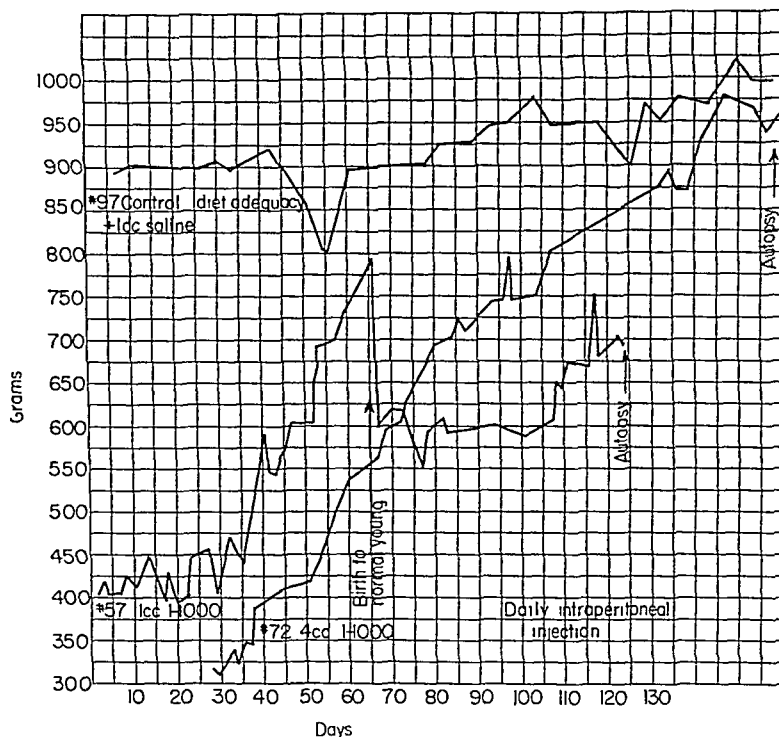


Chart 1 B Daily intraperitoneal injections of dilute aqueous solutions did not interfere with normal development Fig No 57 bred normal young while receiving the injections

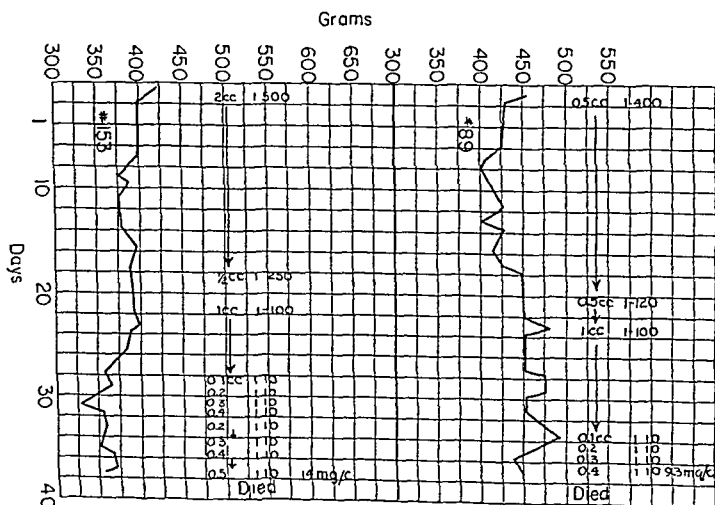


Chart 1 C Daily injections of increasing concentration produced death only when 10 times the minimal lethal single dose was given

TABLE I — REACTION TO THE INSTILLATION OF AQUEOUS SOLUTIONS OF THE COMPOUND INTO THE CONJUNCTIVAL SAC OF HUMANS

	1:1000	1:5000
Patient Ba	slight sting	dry injection
Patient Ro	stings	stings a little none
Patient Di	burns	burns none
Patient Ry	like gravel in eye	scratches injected
Patient Ke	dry	water none
Patient Mu	none	none none
Patient Bl	stings	dry injected
Patient Vi	cool	wet none
Patient McI	slight sting	dry none
Patient Po	smarts	none none
Patient Re	none	slight burn none
Patient Ku	cold	cold injected
Patient Kr	none	none injection
Patient Le	burns	wet injected
Patient Le	smarts	none none
Patient Ma	smarts	scratches none
Patient Wa	dry	none none
Doctor Be	scratches	slight burn none
Doctor Jb	none	smarts none
Doctor Mu	none	none none
Doctor Ha	none	none none
Nurse Ma	slight burning	wet none
Nurse Ro	dry	smarts none
Nurse Ka	none	stings none
Nurse McL	load of dirt	burns injected

The injurious effect of dilute aqueous solution on tissues was studied by instilling several drops into the conjunctival sac of physicians, nurses, and adult patients. Dilutions suitable for effective use as a bactericide provoked minimal subjective sensations depending chiefly upon the type of individual (Table I). No objective reaction other than transient injection of the scleral conjunctiva was noted in the majority of subjects.

The lack of injury to the peritoneum is evidenced by occurrence of conception in the female guinea pig receiving daily intraperitoneal injections of 1 cubic centimeter of 1:1000 aqueous solution of the compound.

Possible idiosyncrasy to the compound was sought for by performing routine skin tests with a 10 per cent aqueous solution on patients being tested to determine the etiology of various allergic complaints. No sensitivity to the germicide was discovered among 26 patients who showed significant reactions to other allergens.

Good skin tolerance for the bactericide was demonstrated in 2000 cases in which the compound was used as the pre-operative skin disinfectant. The skin of every anatomic region and the mucous membrane of all the orifices were exposed to the action of the bactericide. The routine preparation of the operative field consisted of scrubbing the site for 1 minute with soap (10 per cent aqueous suspension of equal parts of

coconut and olive oil soaps) and water until a stiff lather was produced. The lather was removed by shaving the skin rinsed with fresh tap water and dried with a towel. This preparation was carried out at least 12 hours before operation whenever practical, and no dressing was applied during the interval. On the operating table, the operative site was scrubbed with three changes of sponges saturated with 1:1000 aqueous solution of the compound alternated with three changes of sponges saturated with 70 per cent alcohol denatured with oil of cayaput tinted with eosin. The scrub began by swabbing along the contemplated line of incision, then working in concentric strokes from the center of the field toward the periphery. The detergent action of the combination was marked; the soapy aqueous solution emulsified the skin fats and loosened the desquamating epithelium, the contrasting, dry alcohol rolled the detritus off the skin. The skin was left smooth and clean and showed a rosy blush over the prepared area. Following operation, silver foil was applied to the incision and sterile gauze dressings (unwashed 20 by 16 surgical gauze) were secured by zinc oxide adhesive plaster applied directly to the skin. The majority of the dressings were untouched for 5 to 7 days, some not for 14 days. No case of skin irritation was observed that could be attributed to the new compound.

In 3 cases the scalp and portions of contiguous skin were scrubbed with 10 per cent aqueous solution and the moistened hair and encrusted dirt or blood and exudate shaved off. After operation silver foil was applied to the wound and the sterile gauze dressing was secured by a crinoline cast. No skin irritation was noted. In 2 of these cases the 10 per cent solution came in contact with an extensive fresh wound nevertheless healing occurred *per primam*.

Sponges saturated with 10 per cent solution were left for 24 hours in the vaginas of 5 patients following routine dilatation and curettage of the uterus. No irritation was observed. The pre-operative preparation of the skin of the scrotum and perineum was carried out in 3 cases with 10 per cent solution of the compound with no subsequent dermatitis.

The lack of immediate irritation of the skin of the hands and arms and the absence of protracted or cumulative effects following prolonged repeated use were established by using the bactericide as an arm soak following the usual 7 minute surgical scrub. One hundred thirty six individuals (surgeons, medical students and nurses) immersed their arms in a 1:1000 tincture (50 per

TABLE II — BACTERIOLOGY OF FULL THICKNESS BIOPSIES OF SKIN FROM EDGE OF WOUND

	No of cultures
No aerobic growth in 96 hours	55
Staphylococcus albus	11
Staphylococcus aureus	8
Staphylococcus aureus hemolytic	2
Gram positive bacilli	2
Non-pathogenic spore forming bacillus	1
Non-hemolytic streptococcus	1

cent alcohol, 5 per cent acetone) of the compound for roughly 1 minute on a total of over 10,000 occasions during an 18 month period. Two cases of dermatitis were reported. Investigation showed the new bactericide could not be held directly responsible for either. One surgeon proved sensitive to an impurity present in the acetone used in the tincture, the other to the combination of soap and the new compound. The dermatitis promptly disappeared after the cause was removed.

The same group used a 1:5000 aqueous solution of the compound as the germicide in the glove basins. The soapy quality of the solution was found to aid in slipping fingers into the gloves. Surgeons reported that the new compound left the skin soft and supple and chapping during cold weather was uncommon. The nails were not discolored or made brittle, and no objectionable odor was noted.

Bactericidal efficiency of the compound as a skin disinfectant was established by taking full thickness biopsies of the skin in 75 cases. The biopsies, representing all regions of the body except the face and neck, were taken from sites prepared for operation as described above. These full thickness biopsies, averaging 3 by 10 millimeters in size, were taken from one edge of the wound immediately after completing the skin incision. The specimens were transfixed with a silk suture and suspended in 1.5 liters of Ringer's solution to dilute the residual bactericide and prevent its continued action prior to culturing. The suture provided a means of transferring the biopsies to dextrose broth. After incubation at 37 degrees F for 96 hours, the cultures which showed no growth were inoculated with viable organisms to test for bacteristasis. Secondary growth was interpreted as demonstrating absence of inhibition due to bactericide carried over with the biopsy. Seventy-three per cent of the biopsies showed no growth after 96 hours. Among the 25 positive cultures, staphylococci were identified in 21, gram positive bacilli in 3, and streptococci in 1 (Table II). With 4 exceptions, growth occurred only in biopsies taken from the skin of abdomen

TABLE III — INACTIVATION AND DILUTION

TABLE		
Number of times arm soak was used	Highest dilution destroying in 10 but not 5 minutes	Estimated phenol coefficient
8	1:3000	46
14	1:2000	30
34	1:4000	66
45	1:4000	66
63	1:2000	30
81	1:3000	50
93	1:3000	50
108	1:3000	50
126	1:3000	50
132	1:3000	46

Phenol coefficients were determined against 24-hour staphylococcus aureus cultures (Govt 209) at 20° C. The volume of the germicide was replenished daily with fresh 1:2000 tincture. Samples were submitted for test after the arm soak had been used the number of times indicated in the left hand column. The coefficients are estimates of the bactericidal potency since the concentration of the bactericide in the arm soak was approximated in each case.

Deterioration of the bactericide due to inactivation and dilution when used repeatedly as an arm soak was investigated. Surgeons registered on a submerged tally as they soaked their arms in a 1:2000 tincture (5 per cent acetone, 50 per cent alcohol). Samples were submitted daily for the determination of the phenol coefficient (6) as *in vitro* evidence of bactericidal power. The volume of the bactericide was replenished each morning with fresh 1:2000 tincture for 10 operative days. The bactericidal value remained high after 132 soaks (6), as is illustrated in Table III.

The good skin tolerance, low toxicity, detergent action, and bacteriologic efficiency demonstrated for this compound permit its recommendation for the following purposes.

Skin disinfection. The technique for the pre-operative preparation of the skin should follow that described above because mechanical cleansing exposes the bacteria to the action of the germicide. A 1:1000 aqueous solution of the compound provides adequate detergent and bactericidal power.

In regions where mechanical cleansing is difficult because of anatomic considerations or contraindicated by the presence of superficial malignancy, an alternative technique may be employed. A wet dressing of 1:1000 aqueous solution of the compound should be applied for 2 hours prior to operation. When the operative site has been exposed, the skin should be moistened with 1:1000 tincture of the compound (with suitable dye added to stain the area if desired) prior to applying the drapes.

Disinfection of the hands. Scrub the hands with soap and hot water until they are mechanically clean (3 to 5 minutes). Then maintain a stiff

lather (preferably using coconut oil soap) for 3 minutes. The emphasis should be on adding hot soap solution to the lather rather than upon frequent rinsing. Immerse the hands and arms in a 1:1000 tincture (50 per cent chemically pure alcohol, 5 per cent chemically pure acetone) for 2 minutes. Care must be taken to rinse thoroughly so that all soap is removed prior to immersion. Replenish the bactericide daily. Discard the solution after it has been used approximately 150 times.

Glove basins. One liter of 1:5000 aqueous solution provides sufficient fluid for the wet glove technique. The same solution may be used to rinse the gloves throughout the operation. Discard the solution after each operation.

Instruments. Instruments and supplies which do not withstand sterilization by heat should be thoroughly cleansed and submerged in a 1:1000 aqueous solution for 30 minutes. The aqueous solution will not damage optical instruments, rubber goods, shellac catheters, paraffin mesh or gutta percha tissue. Metal instruments however cannot be stored in the solution.

SUMMARY

Investigation of a mixture of coconut oil derivatives (high molecular alkyl dimethyl benzyl ammonium chlorides) has revealed properties other than high bactericidal power which distinguish it as an efficient bactericide for use in the operating room.

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HYSTERECTOMY

A Study of 1,000 Consecutive Operations from a General Surgical Service

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REMOVAL of the uterus is one of the more common surgical procedures performed by the average general surgeon. It is obviously important that the young surgeon be adequately trained in pelvic surgery so that he approaches such problems with well founded confidence. A survey of the literature impresses one with the fact that nearly all the reported experiences with hysterectomy come from the larger gynecological or private clinics. Relatively few studies have been reported from general surgical clinics not having a separate gynecological service. It is the purpose of this paper to analyze 1,000 consecutive hysterectomies performed over a period of 23 years from the public ward of a general hospital by members of a general surgical staff, the majority of whom were in their resident stage of training. Such an analysis of consecutive unselected public ward cases presents for comparison the status of hysterectomy as it is on a general surgical service.

The general mortality for hysterectomy at the present time is extremely difficult to estimate. In the first place, a sufficiently large number of operations must be reported to be of any value. Such numbers usually come from large gynecological clinics staffed with the most expert operators, often representing selected cases with corrected mortality. Then again, a series covering a longer period may have a higher average mortality figure because of the increased number of deaths reported in the earlier days of surgery. In many instances, later series from the same clinics usually show a decrease in mortality. Finally, in some instances, the cases reported from private clinics represent a class of patients who, on the whole, are better surgical risks than the usual public ward patients, possibly a definite factor in the lower mortality figures often reported in these cases.

There has been a considerable variation in the mortality figures reported for panhysterectomy,

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as compared with supravaginal hysterectomy. The term "panhysterectomy" is used to indicate removal of the entire uterus, while supravaginal hysterectomy designates removal of the body, leaving part or all of the cervix. It becomes apparent from a review of the literature, including 16,851 supravaginal hysterectomies (1, 4, 5, 8, 9, 10, 12, 14), and 9,485 panhysterectomies, that the latter carries a somewhat higher mortality. The average mortality for the supravaginal group was 2.4 per cent as compared with 4.1 per cent for the panhysterectomy group. In spite of these figures for the entire group we note several series in which the mortality of panhysterectomy was as low, or even lower, than that recorded for the supravaginal group.

Since the majority of hysterectomies are performed for uterine fibroids, it is of interest to examine several series reported for this one pathological condition (1, 6, 10). In hysterectomy performed for uterine fibroids there was distinctly lower mortality reported for both operations. Seven thousand, one hundred and sixty-nine supravaginal hysterectomies for fibroids were reported with a mortality of 1.4 per cent and 2,654 panhysterectomies with a mortality of 2.2 per cent. Davis and Cusick report that 7.2 per cent of all hysterectomies are performed for uterine fibroids. In the 28 per cent remaining there must be infection and malignancy which probably account for the major portion of the increased mortality reported for all hysterectomies as compared with operations for fibroids only.

During the past few years much discussion has appeared in the literature as to the advisability of routinely performing a panhysterectomy in view of the increasing reported incidence of cancer of the cervical stump. The recent comprehensive study of Von Graff (13), covering the literature of the last 30 years, shows a total of 1,169 cases of cancer of the cervical stump which have been observed or reported following supravaginal hysterectomy. Likewise, in 4,269 cases of cancer of the cervix, he reported 176, or an incidence of 4.1 per

TABLE III —SYMPTOMATOLOGY

Symptoms	755		225		20		1,000
	Supravaginal hysterectomy		Pan-hysterectomy		Vaginal hysterectomy		Total series
	No	%	No	%	No	%	%
Abnormal vaginal bleeding	367	48.5	162	72.0	5	25	52.4
Abdominal pain	362	48.0	77	34.2	6	30	44.5
Tumor	138	18.3	25	11.1	0	0	16.3
Back pain	101	13.4	26	11.5	3	15	13.0
Leucorrhea	75	9.9	38	16.9	9	45	12.2
Urinary disturbances and constipation	89	11.8	19	8.4	12	60	12.0
Dragging pelvic pain (prolapse)	81	10.7	14	6.2	16	80	11.1
Increased fatigue and weakness	32	4.2	9	4.0	0	0	4.1

ally for those cases showing malignancy or marked cervicitis

We find about an equal percentage of the negro race included in each of the two major groups. While the series is very small, it is interesting to note that no vaginal hysterectomies were performed on negro women. Since practically all the vaginal hysterectomies were done for cases of marked prolapse, our figures for this small number of cases agree with those of Fullerton and Faulkner, indicating that the negro woman's pelvic floor and supporting structures are less affected by the strain of labor, or less apt to be the seat of congenital weakness of the pelvic fascia. Of the panhysterectomies performed, 24 per cent were on nulliparae, if we accept chronic irritation from a lacerated cervix or irritating discharge as a predisposing factor in the development of cancer of the cervix, then certainly this group would have been the least likely to develop cancer of the cervical stump had the supravaginal operation been performed.

The age distribution in Table II shows about an equal number of patients in the age groups 30-39 and 40-49 years for the supravaginal operation. In the panhysterectomy group, on the other hand, 24.4 per cent were in the 30-39 years period while 42 per cent were found in the 40-49 years period, which largely accounts for the average age of 43 for the panhysterectomies and 39.5 for the supravaginal group. As was expected, the average age of the vaginal cases is slightly higher, being 48.3 years, while the average age for the entire group proved to be 40.4 years.

In Table III we have divided the common complaints into eight groups, and find that the fre-

TABLE IV —PREVIOUS GYNECOLOGICAL OPERATIONS

Operations	755		225		20		1,000
	Supravaginal hysterectomy		Pan-hysterectomy		Vaginal hysterectomy		Total series
	%	%	%	%	%	%	%
Dilatation and curettage	14.3	22.3	6.25	16.5			
Suspension	6.9	7.3	6.25	7.15			
Oophorectomy	6.7	8.3	6.25	7.5			
Salpingectomy	6.4	7.8	0.0	6.8			
Plastics	4.8	7.3	0.0	5.5			
Operation on cervix	2.7	5.3	0.0	3.4			
Myomectomy	2.7	1.45	0.0	2.4			
Ectopic pregnancy	0.96	1.45	0.0	1.1			
Nature of procedure not known	5.0	4.8	0.0	4.9			
Total percentage of previous operations	50.5	66.0	18.75	55.0			
Per cent of patients with previous operations	33.1	34.5	18.75	33.8			

quency of complaint runs quite parallel in the two major groups of hysterectomies. The greater incidence of abnormal vaginal bleeding in the panhysterectomy group is interesting (72 per cent), but is difficult to explain, unless the cases of malignancy, which are practically all in this group, have accounted for this increase. In comparison with a similar table found in Faulkner's review of 1,544 recent hysterectomies, we note a decided increase in the incidence of the symptoms of prolapse in all three groups of hysterectomy, probably because we have included in this group the dragging pelvic pain of which patients with some degree of prolapse so often complain. As one might expect, the vaginal hysterectomy group has a much higher incidence of urinary disturbances, pelvic discomfort, and leucorrhea, because the majority of the patients have marked prolapse.

The information included in Table IV shows that about one-third of the patients had had previous gynecological operative procedures. We realize that a certain inaccuracy is involved in compiling these statistics because patients are often very vague or in ignorance concerning the exact nature of previous operative procedures.

The figures for previous uterine suspension (approximately 7 per cent) are about equal for all groups, however, in our group of 20 vaginal hysterectomies, we find none who had had any attempt at vaginal plastic repair. The percentages for previous myomectomy—2.7 per cent for the supravaginal group, and 1.45 per cent for the

TABLE I — DISTRIBUTION OF CASES

Number	755		325		30		1,000
	Supravaginal hysterectomy		Pan hysterectomy		Vaginal hysterectomy		Total series
Per cent of total	75.5		32.5		3		100
	No.	%	No.	%	No.	%	
Race							
White	611	81	191	59	20	100	82.2
Negro	144	19	54	17	0	0	17.8
Parity							
0	338	47.3	16	5.0	0	0	52.4
+	417	57.7	109	34.7	30	100	47.6

cent, found in the cervical stump. In a group of supravaginal hysterectomy cases which developed cancer in the cervical stump, and in which data were available, he found 23.5 per cent which developed cancer during the first year after operation (probably present at the time of operation), and 76.5 per cent in which it appeared from 1 to 20 years later.

These rather startling figures would seem to be strong evidence in favor of routine panhysterectomy (11), but certain other facts should likewise be considered. As pointed out by Von Graff (13), it is probable that a certain percentage of the cases recorded may represent duplicates or the same cases reported twice. Likewise we have no knowledge of the number of supravaginal hysterectomies performed to give us a percentage basis for estimating the incidence of this unfortunate occurrence. It is possible that the incidence in relation to operation might still prove to be lower than the difference in mortality which apparently exists between panhysterectomy and supravaginal hysterectomy. Also the increased morbidity and the greater number of postoperative complications and accidents associated with panhysterectomy which various reports show, must be taken into consideration. As Graves so aptly pointed out, those cases which represent the increased mortality of panhysterectomy over supravaginal hysterectomy are irrevocably dead whereas those which develop cancer of the cervical stump have several years of life with modern radium treatment and even a chance for complete relief. It would seem to us then that in those clinics where a large portion of the operating is performed by less experienced operators and on patients who may prove to be poorer surgical risks the increased mortality of panhysterectomy over supravaginal hysterectomy would outweigh the risk of the development of cancer in the cervical stump. We do believe however that future studies will show a decrease in operative mortality for panhysterectomy and with the probable in-

TABLE II — AGE DISTRIBUTION

Age: years	755		325		30		1,000
	Supravaginal hysterectomy		Pan hysterectomy		Vaginal hysterectomy		Total series
	No.	%	No.	%	No.	%	
10-19	4	0.5	0	0.0	0	0.0	0.4
20-29	88	11.6	19	5.9	1	3.3	1.1
30-39	206	27.3	55	17.0	3	10.0	31.6
40-49	236	31.2	106	32.6	4	13.3	38.8
50-59	57	7.5	33	10.2	5	16.7	9.7
60-69	20	2.6	0	0.0	5	16.7	2.6
69	4	0.5	5	1.5	0	0.0	0.7
Average age	39.5		41		45.3		40.4

creasing recognition of cases of cancer of the cervical stump, there will be a tendency toward the more frequent choice of panhysterectomy.

This series of 1,000 consecutive hysterectomies represents the number of public ward cases which have been submitted to hysterectomy from August 1913 to November, 1936. The several Wertheim operations performed have been included with the panhysterectomy group, which undoubtedly accounts to some extent for the increased mortality of this group. No effort has been made to indicate when tubes and ovaries were totally or partially removed but our practice has been usually to preserve one or both ovaries if normal. The panhysterectomies represent a mixed group so far as operative technique is concerned. During the last 4 years the majority of panhysterectomies were performed by means of a method similar to that advocated by Weir. During this analysis we noted the relatively few times that cervical cauterization or repair preceded supravaginal hysterectomy. If supravaginal hysterectomy is to be employed, then it should be accompanied more frequently by attention to the lacerated cervix, and coming out of the endocervix in order to cut down the incidence of continued vaginal discharge or possible cervical stump cancer.

We believe the results of this analysis can best be presented in a series of tables with a few comments on the essential features as shown in each table. In Table I, it will be noted that the number of supravaginal hysterectomies is three times as great as that for panhysterectomies and only 3 per cent of the whole group were vaginal hysterectomies. As previously observed, the major portion of the panhysterectomies has been done during the last 4 years previous to this time the panhysterectomy operation was reserved gener-

TABLE VIII — MORBIDITY AND TIME OF OPERATION

Highest postoperative temperatures (rectal—F)	755		225		20		1,000
	Supravaginal hysterectomy		Pan-hysterectomy		Vaginal hysterectomy		Total series
	No	%	No	%	No	%	%
	No	%	No	%	No	%	%
98.6°—100.5°	248	32.7	41	18.3	6	30	29.5
100.6°—101.5°	375	49.6	113	50.3	5	25	49.3
101.6°—102.5°	100	13.5	54	24.0	6	30	16.0
102.6°—and above	32	4.2	17	7.4	3	15	5.2
Afebrile in 5 days or less	347	46.0	80	39.6	8	40	44.4
Operating time in minutes	114.7		110		83.25		112
Average days in hospital	21.1		20.7		23.2		21.1

panhysterectomy, 19.5 per cent, as compared with 10.6 per cent for supravaginal hysterectomy. In particular we note the marked increase of cystitis following panhysterectomies, and definite but less notable increases in phlebitis, wound disruption, wound infection, and pelvic infection, as compared with supravaginal group.

In estimating the comparative morbidity of the 3 groups, as listed in Table VIII, we have selected two criteria: first, the highest postoperative temperature, and second, the duration of fever as shown by the temperature curve. On the whole the panhysterectomy group was characterized by slightly higher postoperative elevations of temperature. It is interesting to note, however, that 32.7 per cent of the supravaginal group and 18.3 per cent of the panhysterectomy group enjoyed practically afebrile courses, the maximum elevation reaching only 100.5 degrees F by rectal reading. When the rectal temperature did not surpass 101.5 degrees F we considered the course to be essentially normal with no more than the expected mild febrile reaction which follows most operative procedures. In this category we find 82 per cent of the supravaginal, and 68 per cent of the panhysterectomy operations. The group in which the temperature curve dropped to 99 degrees F within the first 5 postoperative days, and when the patient remained essentially afebrile throughout the remainder of the convalescence, includes 46 per cent of the supravaginal and 39.6 per cent of the panhysterectomy operations.

The values given for relative duration of operation in each group represent the actual operative time, total anesthesia time can be found by adding about 30 minutes to these figures to cover the time of induction, transfer to the operating room,

TABLE IX — MORTALITY

Operators	755		225		20		1,000
	Supravaginal hysterectomy		Pan-hysterectomy		Vaginal hysterectomy		Total series
	No	%	No	%	No	%	%
Visiting staff (6)	208	27.6	58	25.8	6	30	27.2
House staff (79)	547	72.4	167	74.2	14	70	72.8
Mortality							
Visiting staff (6)	208-4	1.9	53-4	6.9	6-0	0	2.9
House staff (79)	547-8	1.5	167-5	3.0	14-0	0	1.8
Gross mortality	1.6		4.0		0.0		2.1

preparation and draping of the patient. Fully 95 per cent of this series have had the usual ether anesthesia with gas-oxygen induction, spinal anesthesia was reserved for a few selected cases, and avertin has been employed only on rare occasions for hysterectomy.

Table IX, listing the mortality figures, has been divided to show the relative percentages for the visiting staff of 6 surgeons as compared to the house staff, which has included 79 internes, assistant residents and residents throughout the 23 year period. The higher mortality figures for the visiting staff is explained by the fact that the more difficult cases and the poorer operative risks were usually found in their list of cases. The gross mortality figures of 1.6 per cent for the supravaginal group and 4.0 per cent for the panhysterectomy group are slightly below the average figures of 2.4 per cent and 4.1 per cent, respectively, which were previously mentioned as possibly representing a grand average of many hysterectomies done under varying conditions over an extended period of time. In our series of 1,000 cases, as in many other series extending over 20 year periods, a good portion of the increased mortality for panhysterectomy is the result of the more radical operations performed for malignancy in the earlier years. With the advent of radium as the treatment of choice in most cases of cancer of the cervix, and the resulting decreased use of the radical Wertheim procedure with its increased mortality, and incidence of postoperative complications, the mortality figures for panhysterectomy undoubtedly will more nearly approximate those for the supravaginal operation. In our study, we note that 135 of the panhysterectomy operations were performed during the last 4 years, with a mortality of 2.96 per cent, somewhat lower than the figure for our entire group of 225 panhysterectomies. In passing, we are pleased to report no hysterectomy mortalities for the last 2 years.

TABLE V — ASSOCIATION OF OTHER OPERATIONS WITH HYSTERECTOMY

Operation	735		225		20		Total cases
	Supravaginal hysterectomy		Pan hysterectomy		Vaginal hysterectomy		
	No.	%	No.	%	No.	%	
Laparotomy only	631	83.6	107	82.7	2	5	82.0
Laparotomy with perineal plastic	28	11.8	2	0.8	10	95	17.9
Hyst. rectomy with other operations	23	1.7	2	1.3	0	0	2.6
Two-stage or a separate operation	3	2.0	3	1.3	0	0	2.5

panhysterectomy group—are unusually low (and we suspect that figures for a more recent series would show a definite increase for this operation)

The statistics in Table V indicate that laparotomy alone was done in a large majority of the cases in both the supravaginal and panhysterectomy groups, in about equal percentages. The fourth group, listed as 'hysterectomy with other operations' is meant to include operative procedures other than vaginal plastic work, which accompanied laparotomy. The last category includes any two or more operative procedures carried out at separate times during the period of hospitalization. In many cases salpingectomy or oophorectomy was done with hysterectomy but

TABLE VI — PATHOLOGICAL FINDINGS

Pathology	735	25	20	1000
	Supravaginal hysterectomy	Pan hysterectomy	Vaginal hysterectomy	Total women
	No.	No.	No.	Per cent
Uterine fibroids	14	11.5	5	61.5
Ovarian cysts	108	30	1	14.4
Salpingitis	168	15	0	18.6
Chronic cervicitis	47	24	14	14.0
Oophoritis	50	6	0	6.5
Uterine polyp	40	21	2	6.4
Endometritis	43	10	0	5.9
Carcinoma body of uterus	8	30	0	3.8
Carcinoma cervix	2	21	0	2.4

neither has been listed as a separate operation in this table. Incidental appendectomy is almost a routine procedure and likewise was not classified as a separate operative procedure.

The pathological findings, as tabulated from the individual pathological reports are listed in Table VI. In the entire 1000 cases the incidence of uterine fibroids is 63.3 per cent which is slightly lower than the figure given by Davis and Cusick 72 per cent.

As one would expect, the relative incidence of cancer of the cervix and body is very much higher in the panhysterectomy group at the same time salpingitis, oophoritis and ovarian cysts are considerably more frequent in the supravaginal group. The incidence of chronic cervicitis is, of course greater for the panhysterectomy group because this table is based upon reports from pathological specimens and 76 per cent of this series were multiparæ, a large percentage of which had lacerated cervixes. The number of cases of cancer in this table represents a slightly higher incidence than that reported by other authors. In addition to many more common pathological conditions not included in Table VI there were reported 2 cases of metastatic carcinoma to the uterine body, 2 cases of leiomyosarcoma, 2 cases of hydatidiform mole, 2 cases of hemangioma of the uterus and 1 case of chorioepithelioma. In the entire series there were recorded 3 cases of tuberculosis of the genital organs.

Table VII lists the postoperative complications which prolonged or varied the convalescence in such a manner that a definite diagnosis could be made and also those unfortunate complications which led to a fatality. Of special interest is the increased incidence of complications following

TABLE VII — POSTOPERATIVE COMPLICATIONS INCLUDING FATALITIES

Complications	735	25	20	1000
	Supravaginal hysterectomy	Pan hysterectomy	Vaginal hysterectomy	Total cases
	No.	No.	No.	Per cent
Pneumonia	15	5	2	1.0
Pulmonary embolism	10	4	0	1.4
Pelvic infection	5	3	2	2.3
Wound infection	1	0	0	1.7
Wound disruption	3	1	0	0.6
Hematoma	5	0	0	0.3
Cystitis	8	13	1	1
Phlebitis	6	5	0	1.1
Intestinal distention	2	0	0	0.2
Fever of unknown origin	3	0	0	0.4
Miscellaneous	4	1	0	0.5
Total no. of complications	80	44	4	
Total percentage of complications	10.6	9.5	10.0	1.8

the presentation of any definite conclusions, because of the many variable factors which reduce the value and comparability of apparently similar statistics. There are, however, certain general impressions which are to be gained from such a study.

A review of the literature shows a higher mortality for panhysterectomy as demonstrated in the majority of individual studies reported and also by a calculated average mortality for the entire group of reported series which was considered. Even in series reported for uterine fibroids only, the mortality figures for panhysterectomy are higher than those reported for the supravaginal operation. We believe, however, that studies restricted to a more recent period of time and those of hysterectomy of the present era will show a decrease in mortality figures for panhysterectomy. This, then, would remove one of the chief arguments against the routine use of total hysterectomy in the effort to reduce the apparently mounting incidence of recognized cancer of the cervical stump.

It is our impression that the mortality figures of this study do not justify the routine use of panhysterectomy in all cases, since the incidence of cancer of the cervical stump in this series of 755 supravaginal hysterectomies, as far as could be determined, was only 0.4 per cent. If supravaginal hysterectomy is to be maintained as the operation of choice in the majority of cases, however, more frequent and careful treatment should be given to the lacerated cervix at the time of hysterectomy in order to reduce the danger of cancer of the cervical stump and likewise the

incidence of continued postoperative vaginal discharge.

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TABLE X — MORTALITY FOR SEPARATE PATHOLOGICAL CONDITIONS

Major pathology	755		28		20		1,000	
	Supravaginal hysterectomy		Pan-hysterectomy		Vaginal hysterectomy		Total series	
	No.	%	No.	%	No.	%	No.	%
Uterine fibroids	514-9	1.7	118-3	2.8	5-0	0	633-12	1.9
Carcinoma body	8-0	0.0	30-4	13.3	0-0	0	38-4	10.5
Carcinoma cervix	1-1	0.000	23-1	4.3	0-0	0	24-2	8.3
Metastasis	41-3	4.0	22-0	0.0	0-0	0	63-3	3.3

When we consider the mortality for hysterectomies performed for uterine fibroids, as shown in Table X, we find about the same mortality in the supravaginal group (1.7 per cent), but a decreased figure for the panhysterectomy cases (2.8 per cent), when compared to our gross mortality figures. Referring back once more to the rates which could be taken to represent the average mortality for several large series of cases performed for uterine fibroids over an extended period of years and under varied conditions, we find our figures slightly higher than the calculated 1.4 per cent mortality for supravaginal and 2.2 per cent for panhysterectomy operations. Table X likewise shows the increased mortality found in cases of malignancy which raises the rates for the entire series. This especially noticeable in the panhysterectomy group.

In the list of causes of death in Table XI, we note that 28.5 per cent of all deaths were caused by pulmonary embolism and 14.5 per cent by some other postoperative pulmonary complication. Read and Bell give their mortality from pulmonary embolism as 35.1 per cent for 1,739 supravaginal hysterectomies and 10.5 per cent for 605 panhysterectomies.

TABLE XII — FOLLOW UP STUDIES

End result	376		120		11		57
	Supravaginal hysterectomy		Pan-hysterectomy		Vaginal hysterectomy		Total No. of cases
	%	°	%	°	%	°	%
Asymptomatic	86	69.7	94	78.3	3	7.3	70.8
Partial relief	85	0	3	7.5	7	63.6	3
Not improved	14	3.7	3	2.5	1	0	3.6
Postoperative hemi	25	4.0	3	2.5	0	0	3.6

TABLE XI — CAUSES OF DEATH

Major cause of death	755		28		20		1,000
	Supravaginal hysterectomy		Pan-hysterectomy		Total series		
	No.	%	No.	%	No.	%	
Pulmonary embolism	3	25.0	3	33	6	28.6	
Circulatory	3	25.0	3	33	4	20.0	
Pneumonia	1	8.3	3	33	3	14.3	
Febrile phlebitis	1	8.3	1	11	3	9.1	
Wound infection (B. welchii)	1	8.3	2	22	2	9.1	
Other causes	3	25.0	1	11	4	20.0	

Finally, we have attempted to give the results of follow up studies on 376 supravaginal hysterectomies, 120 panhysterectomies, and 11 of the vaginal group, roughly, about 50 per cent of the entire series. We wish to draw attention to the fact that a greater percentage of the panhysterectomy group obtained complete relief of symptoms namely 78.3 per cent as compared with 69.7 per cent for the supravaginal cases. In compiling these statistics it was a noteworthy fact that a considerable number of the supracervical cases complained of continued vaginal discharge many of them requiring further treatment to the cervical stump.

The greater incidence of postoperative ventral hernia in the supravaginal group is explained by the fact that in the early years of the series, the cervical stump was commonly suspended by fixation to the abdominal wall. In recent years the stump has been suspended by the round ligaments, which may account for the resulting decrease in the incidence of postoperative hernia. In the few cases of vaginal hysterectomy which were followed up it was apparent that several had obtained only partial relief from the urinary difficulties which accompanied the original prolapse.

In our 755 supravaginal hysterectomies 3 cases of cancer of the cervical stump were found representing an incidence of 0.4 per cent. In 2 other cases in which hysterectomy had been performed elsewhere patients were seen and treated also.

SUMMARY AND CONCLUSION

In considering similar statistical studies reported from gynecological clinics and records of private practice it becomes apparent that the results presented in the tables of this analysis are comparable, with only a rare exception to equivalent tables in these other papers. We feel however that the results of our series do not justify

out to find truth we must do so with a pure heart and humble spirit. We must apply to each new fact or theory that presents itself to us for acceptance the same exact and impartial methods of test and trial, and we must be ready to accept the verdict of those tests. We must be prepared for anything and be prepared to meet it fearlessly. For the truth, when we see it face to face, may not be in the guise we imagined; it may override our most cherished theories, upset our hopes, even smash our careers. No great man has pretended that truth is kind or friendly. It has been described as naked, as blindfold, as a flaming sword—never as a cook-housekeeper or a woolly waistcoat. We are told “the truth shall make you free,”—not happy; we are told “great is the truth and it shall prevail,”—it, not you. Yet there is something in the vision, in the discovery, in the possession of truth, cold and uncertain though that possession may be, that has inspired the noblest spirits of all times to forsake everything to become her followers. “Beauty is truth, truth beauty, that is all we know in life, and all we need to know.”

In surgery we are constantly engaged in the search for truth. We wish to know about the origin of disease, about its progress, about its vulnerability to the many alternative weapons with which we seek to attack it. We devote our days to the practice of our work, our nights and our leisure to its study. But the problems we attack are long and difficult ones and the possibilities of error are many. Noxious agents vary in their action and human beings in their reaction to them, even in groups that appear strictly comparable in age, sex, physical habitus, occupation, and environment. Surgical treatment cannot be reproduced in different centers with the exactness of chemical experiments in different laboratories, for surgeons vary in skill, tempera-

ment, and in their selection of material. We cannot hope to settle, or even to form an opinion on, more than one small aspect of the problems we attack in a lifetime. We should not, for this reason, be discouraged from seeking the truth ourselves, for truth is revealed only to the constant inquirer, but we must leave much of this inquiry to others. We must then choose between the conclusions of many men working at the same problem in different lands. Where does truth lie? Not in numbers, for a small series carefully observed and recorded by a critical expert may mean more than several hundreds furnished by a team and analyzed by slide rule. Not in the magic of a name, for truth may lie in the contribution of the small town practitioner, penned apologetically and hidden in the pages of a little read journal, rather than in the figures hammered out by platinum secretaries in the chromium laboratories of the million dollar professor. We must judge others, and the basic problem seems to be this,—how to recognize truth when we see it. We have already agreed that truth being a matter of intense conviction rather than exact proof, it can be reached by the spirit rather than the intellect, so we shall find truth in others by spiritual affinity rather than by intellectual analysis. The more we cultivate truth ourselves, mix with truthful men, test the accuracy of our words before we speak them and of our writings before we let them go abroad, develop in our consciousness by the study of writings that time has shown to be redolent of truth, not alone those of surgical masters but of all great men, an orientation that will lead us to truth as the pigeon is led to his own cote, the more certain will be our instinct, the more direct our intuition. Blessed are the truthful, for they shall see truth.

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EDITORIALS

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NOVEMBER 1938

SIR DAVID P. D. WILKIE

WITH sorrow the editorial staff of SURGERY GYNECOLOGY AND OBSTETRICS has learned of the death of one of its most honored members Sir David Wilkie. Sir David was a distinguished surgeon and a leader in his profession in England. His career was characterized by many fruitful accomplishments. In a subsequent number we will give more adequate recognition to his achievements.

TRUTH

NO pleasure is comparable to the standing upon the vantage ground of truth, says Bacon in his well known essay, as if truth were indeed a fixed peak whence having at last reached it we could look round upon the plains of uncertainty and the chasms of error. If it were so would men spend their lives and energies

to discover it or shed their blood to defend it?

When we speak of truth we indicate an opinion and admit the possibility of another opinion, but while allowing that the matter is open to discussion, we imply that among reasonable men, such discussion can only lead to the conclusion to which we ourselves have been led. In matters of fact, in which no divergence of opinion is possible we talk of accuracy. In matters of the emotions such as poetry or music, in which the criterion is one of individual sensibility, we should use words of praise and speak of excellence or *beauty rather than truth*. We select the word truth as particularly applicable to those objects of deliberation which are open to argument while they are open to argument and when the argument is nearly but not quite settled. Evolution was an interesting theory or a heresy to Darwin's contemporaries a truth to his successors a fact to us. But there are whole realms of thought such as religion, economics, and politics in which the basis of argument is not a set of facts but a set of assumptions about the nature of man and the universe. In these regions truth can never pass from the pedestal of adoration to the glass case of acceptance, it will remain the truth only as long as those basic assumptions are the belief of the majority of mankind, and when they are displaced it must give way to a new truth.

It follows therefore that there is no such thing as absolute truth. Truth is for each of us something personal something that we have tested and accepted and which we are prepared to defend. But while truth is of our discovering it is not of our making. When we set

in a minimum of 1 in every 6 patients operated upon for gall stones, or 16 to 20 per cent.

In 4 per cent of the cases, stones were removed from the ducts when no stones were found in the gall bladder. The ducts have been opened in 718 cases and stones have been removed in 323 cases. The mortality in the face of these explorations has gone progressively downward and not upward.

The deductions which we draw from our experiences in these cases are: if common duct stones are not found in approximately this percentage of cases, serious consideration should be given to the possibility that common duct stones are being left after cholecystectomy, to find and remove the highest percentage of common and hepatic duct stones, at least one negative exploration for each positive duct stone demonstrated must

be expected; the character of the bile removed by hypodermic syringe from the common bile duct is an excellent additional criterion as to whether or not a duct should be explored. In experienced hands exploration of the ducts not only does not add to the immediate risks of operations for gall stones, but undoubtedly diminishes the eventual mortality and morbidity. Each surgeon must settle what the risks of these operative procedures are as relates to his own experience, facility, and equipment. This is a flexible situation with prize and penalty ever present. However, the percentage of patients with gall stones, and with stones within the ducts, is a quite inflexible and constant situation and the possible penalty of recurrent colic and dangerous jaundice after incomplete operations is ever present. FRANK H. LAHEY.

THE THIRD ERA IN THE SURGICAL TREATMENT OF CHOLELITHIASIS—REMOVAL OF ALL STONES IN THE DUCTS

AS stated in a recent article, we have passed through two eras in the treatment of gall stones and are now well into a third era. During the first era gall stones were removed from the gall bladder by cholecystostomy, but because the factors which produced the gall stones or associated cholecystitis still remained in the unremoved gall bladder wall, this method of treatment was soon abandoned, and a second era commenced.

In the second era, not only the gall stones but the infected wall of the gall bladder were removed by cholecystectomy. Little attention, however, was given to the possibility of associated common or hepatic duct stones unless they had produced obstructive symptoms as indicated by an associated jaundice. In 1927, I became dissatisfied with the results which we were obtaining with this method of cholecystectomy and began practicing and preaching that with cholecystectomy the common and hepatic bile ducts should be explored more often than had been customary and upon quite different criteria. Thus we come to the third era.

With an experience of more than 1500 operations for the removal of gall stones in a period entirely within the third era, it seems justifiable on this experience to make deductions relating to this era and, if this era in the treatment of cholelithiasis is to represent advancement over the past two eras, to state the purpose to be accomplished. The purpose plainly is this that when a patient is operated upon for gall stones, all the gall stones, including those in the ducts should be removed.

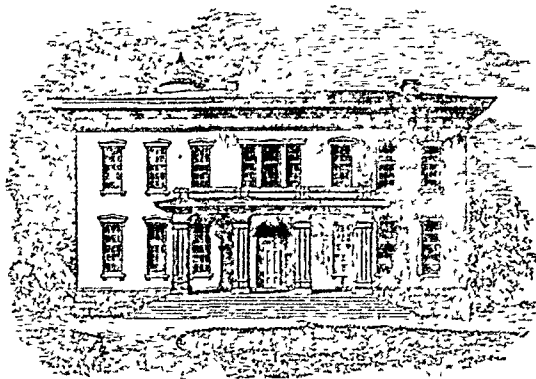
In 40 per cent of our cases in which stones have been found and removed from the com-

mon bile ducts, jaundice was not and had not been present in the history. Jaundice, then, is an obviously unreliable indication for exploration of the ducts. Therefore, in my earlier papers on this subject, other indications were set up for opening and exploring the ducts, as follows: The presence of a thickened or contracted gall bladder, the presence of a dilated duct, the presence of a palpable or suspected as palpable stone, and the presence of a thickened head of the pancreas. All of these criteria have proved and continue to prove valuable. To these we have now added still another and even more valuable indication for opening, exploring, dilating the sphincter of Oddi, and draining the common bile duct, that is, the character of bile which is obtained by puncturing the duct with a hypodermic syringe and drawing off a glass syringeful of bile. When the bile in the glass barrel of the syringe, viewed by transmitted light, is clear and golden yellow in color, rarely will a stone ever be found in the ducts and rarely will exploration of the duct be necessary. When the bile, by transmitted light, is murky or deeply clouded, stones will frequently be found within the ducts when none of the above criteria are present. Even if no stones are found but merely infection of the ducts is present, it will be valuable to produce internal drainage by dilatation of the sphincter of Oddi and external drainage for 12 days by the introduction of a T tube for that time. Long continued infection within the ducts is undoubtedly more frequently the cause of formation of stones within the ducts than is their passage from the gall bladder into the ducts.

In the past few years we have consistently explored the ducts in from 40 to 50 per cent of our patients operated upon for gall stones. This has resulted in our finding and removing stones from the common or hepatic bile duct

the question of body snatching was particularly present in the minds of the citizens of Berkshire County. In 1820 Pittsfield was a town of about twenty-five hundred people and during that year the body of a young man of a prominent family was stolen from its grave. In such a small community the feeling attained mass proportions and at a town meeting a committee was appointed to prevent in the future "the horrid and savage practice" of body stealing. This committee discovered that there was no statute of the commonwealth which bore on the subject, and it was not until 1830 that such a statute was passed by the legislature. In 1822 when the medical school was proposed the matter was still fresh in the public consciousness and there was a considerable outcry against bringing into their midst such a villainous possibility as a medical school. The trustees, however, in their first prospectus met this question by the rather quaint statement that the town would be much safer in having an established seminary which could by proper means obtain anatomical material, and they promised to protect the public "with a most sacred regard to private feeling as well as public sensibility." By-laws were established with stringent regulations and punishments but unfortunately these did not altogether succeed. Several instances occurred to keep the town in a furor and finally in 1830 there was an explosion of public sentiment which almost wrecked the school. Two bodies had been stolen from out-lying farms and the deed was traced to two students of the college, who were arrested. A full town meeting was held and a Major Goodrich offered to lead a party of citizens "to demolish the college buildings unless the ghastly prey of the students was given up." The meeting ended in the usual resolutions, however, and it was shortly afterward that proper legislation fairly well put an end to further troubles.

In spite, then, of politics, of public apprehension and lack of financial assistance, the school was established and the first full course was begun in 1823 with some forty students. Dr. Jonah Goodhue of Hadley, one of New England's most distinguished physicians, was named the first president. In 1821 the Pittsfield Hotel (Democratic) "had become unprofitable and the pacification of parties rendered it no longer necessary." Dr. Childs, the proponent of the school, held a large interest in this hotel and in 1822, apparently with the school in mind, a deed of the premises was made over to him. As it stood, the building was fairly suitable as a dormitory and boarding house, and in addition a coach house in the rear offered a building for anatomical and laboratory studies. Here in 1822 twenty-five students began an informal course. The fact that the institution had buildings and students as a nucleus aided greatly in the petition to the legislature, and at the same time created enough confidence among the people of the town so that three thousand dollars was raised. This three thousand was the sole financial backing the school had to start with and from then till its close the institution was never out of debt. Occasional



Berkshire Medical Institute 1851-1870

small grants were obtained from the legislature in later years, but the income seems to have been derived principally from tuitions and from an interesting scheme of assessing the faculty from time to time. The following tuition table was established:

For all the lectures	\$40 00
Yearly tuition (exclusive of lectures)	50 00
Graduation	12 00
Professor Dewey's lectures on natural sciences	6 00
Students destined for missionary labors were admitted	free

The lecture term was set at 15 weeks, and the conditions for admission for the degree were announced as follows:

"Before a candidate can be admitted to an examination he must give satisfactory evidence that he possesses a fair moral character, a competent knowledge of the Latin language, and has studied three full years in this institution or under the tuition of a respectable practitioner and has attended two full courses of lectures on the following branches: Anatomy, Physiology, Surgery, Theory and Practice of Medicine, Materia Medica, Pharmacy, Chemistry, and Midwifery. A competent knowledge of Natural and Experimental Philosophy, Botany and Legal Medicine will also be required."

Before presenting himself for the degree the student was also required to write a dissertation and read and defend it on the day of Commencement.

On July 1, 1823, the trustees announced the course of lectures and the names of the first faculty:

Surgery and anatomy, and physiology as subservient to the theory of and practice of medicine and surgery, Dr. J. P. Batchelder, theory and practice of medicine, Dr. H. H. Childs, obstetrics, Dr. Asa Burbank, materia medica and pharmacy, Dr. John DeLaMater, chemistry, botany, mineralogy, natural and experimental philosophy, Professor Chester Dewey (Wilhams).

Three of these men were local physicians whose energies had gone to establish the school, and who for some years carried the burdens of the teaching and general management. These burdens were many due to the constant difficulties with finances, discrimination by the State medical society in favor of Harvard graduates, and the dependence upon

EARLY AMERICAN MEDICAL SCHOOLS

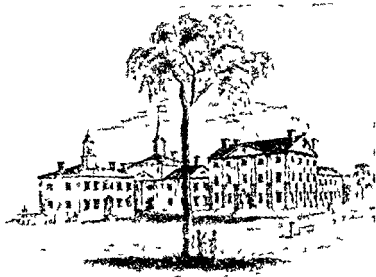
THE BERKSHIRE MEDICAL INSTITUTE

GEORGE STODDARD REYNOLDS, M.D. F.A.C.S. Pittsfield Massachusetts

THE horror of body snatching and the conservatism of Harvard two remote but powerful antagonists nearly prevented the foundation of the Berkshire Medical Institute.

In 1821 Dr H H Childs of Pittsfield Massachusetts at the suggestion of Dr J P Batchelder then teaching at Castleton Vermont urged upon the Berkshire District Medical Society the establishment of a medical school in western Massachusetts

developed by many of the medical men at Harvard and in the eastern part of the state. This opposition was founded in the fact that Berkshire County had generally been a seat of rugged individualists particularly progressive Democrats who had antagonized the Conservatives in Boston. The parent state medical society felt too that in addition to the quality of the politics there might be some question of the quality of the teaching. The petition was therefore



The Berkshire Medical Institute 1821-1830. From left to right Town House
Institute Boarding House

At that time there were six well established schools in New England but these energetic gentlemen felt that Berkshire County in the northwestern corner of the state offered a center which could well cover areas not near the already established schools and furnish some organized but inexpensive medical education to the young men of a country district who could ill afford study in the larger cities and universities. The County medical society promptly appointed a committee to present a suitable petition for a charter to the legislature and this was done in June 1822. Immediate and considerable opposition

put over until the autumn meeting of the legislature but finally on January 4 1823 it was signed.

The charter provided the usual powers to a board of trustees but the grant was disappointing in that no money went with it as the proponents had counted on a sizable gift from the state. Moreover in order to satisfy the questions of politics and quality it was especially provided that the degrees should be given by Williams College in order that the same rules and restrictions should be adopted as those maintained by the University at Cambridge.

In the decade of 1820 to 1830 covering the time of establishment of the Berkshire Medical Institute

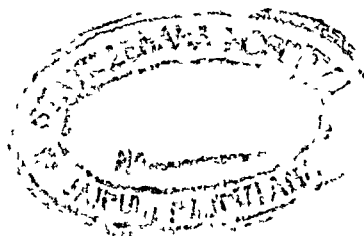
¹H Harvard Dartmouth Geneva Yale Vermont at M.D. 1837 Bowdon

of medical character. It had attracted to Pittsfield, in its faculty and others, persons of culture, who had adorned the society of the village while they mingled with it, and left it the better for their presence. And, when it could no longer creditably perform the work which was entrusted to it, it gracefully yielded the place to those who could."¹

It was a noble attempt by a group of country doctors to improve the standards of medical teaching

¹Smith's *History of Pittsfield*.

and education in the less accessible regions, an attempt to provide orderly instruction at a low tuition fee commensurate with the ability to pay instead of the questionable and haphazard system of individual tutoring. In this it did prove to be successful, but as transportation facilities and more and better schools situated in cities with a university began to develop, the need decreased steadily and the economic law of supply and demand asserted itself.



Williams College for both degrees and laboratory apparatus. However in spite of it all the institute grew steadily in members and importance until finally in 1837 the Massachusetts medical society voted admission and the same rights to the graduates as those enjoyed by the graduates of Harvard. In the same year the legislature dissolved the connection with Williams and constituted the school at Pittsfield as an independent college. In the mean time President Goodhue had died and had been succeeded by Dr Zadock Howe of Billerica. In 1837 Dr Howe resigned and Dr H H Childs the real founder and the hardest worker on the faculty was elected. He remained as president till his death in 1868 at the age of eighty five.¹

It is interesting to note that the requirements for the degree were practically unchanged from 1823 to 1871—the life of the college. Tuition with a private practitioner still appears as the main backlog of the students' education and the impression is left that the lectures were provided more in the way of a high polish than as the basic instruction in the practice of medicine. Probably the experience of Mark Hopkins subsequently the eminent president of Williams College is fairly typical of the medical students' career in those days. Shortly after graduation from Williams Mark Hopkins decided to study medicine. At that time he was tutoring at Williams and he requested one of the local physicians to give him instruction. For a short time this was carried on and Hopkins then moved to New York taking rooms with a professor of medicine. With this man he studied for 7 months and then in May 1828 entered the Berkshire Medical Institute. He attended lectures at the institute for another 7 months supporting himself meanwhile by tutoring in a boys' school getting up at 4.30 every morning to get through his work. The load was too heavy to carry however and he returned to New York keeping his connection with the medical school. In New York he lived and studied with a Dr Smith went to occasional medical lectures and again supported himself by tutoring in a girls' school. Finally in July 1829 he sent his final dissertation to Pittsfield and received his M.D. degree.

During the years of 1840 to 1850 the number of students averaged about 130 and these were the most prosperous years of the college. In 1850 the

old coach house was burned to the ground. This building had been moved and enlarged from its original state and was used for lecture rooms laboratory and anatomical dissection. Prompt measures were taken to repair the loss and a grant of ten thousand dollars was obtained from the legislature for a new building. The citizens of Pittsfield subscribed an additional five thousand dollars and the new building was erected on a new site offered by Henry Colt Esquire. This building was of brick and in every way commodious and well suited for its purpose. The old hotel which had served so long as a boarding house was sold and demolished and students thereafter boarded with the townspeople. The year 1852 was marked by the addition of a very valuable and excellent collection of anatomical models surgical apparatus etc. sent from Paris by Dr Timothy Childs the son of Dr H H Childs.

One lack was very evident in the facilities—namely hospitals in whose wards clinical teaching could be carried out. To meet this need a weekly clinic was instituted at which free diagnosis and treatment were given in the presence of the students. Also during this time many young and brilliant men were added to the faculty among them being Dr William Green in surgery Dr R C Stiles in pathology Dr A B Palmer and Dr Willard Parker in medicine Dr P Chadbourne in chemistry and Dr Pliny Earle in nervous diseases. These men all gave their best energies to the college and in 1861 a medical journal was begun which although it lasted only 1 year was promptly recognized as being an important publication.

In spite of the best efforts to keep the school going however it was becoming evident that it was a losing fight. The Civil War was to prove as disastrous to the school as it did to many other smaller country institutions, and the ever present financial difficulties together with lack of hospitals and an associated university were obstacles which could not be surmounted. By 1867 there were only 35 students affording compensation of only one hundred and thirty dollars to each professor. Such salaries could not of course hold good men in the professorships. The trustees nevertheless made one last desperate effort and managed to obtain three thousand dollars by a mortgage most of which went for repairs and the introduction of gas and water into the college building. This was only a temporary check to the decline of the institution and finally in 1869 permission was obtained from the legislature to give to the Athenaeum what might be of interest in the way of apparatus library etc. and to sell the rest of the property. The building was sold in 1871 to the Town of Pittsfield and was remodeled for use as a high school.

The institution thus honorably closed an honorable career. In an existence of forty four years it had graduated 1138 doctors in medicine who held a rank in their profession equal to that of the present out by any college. It had had a large share in the advancement of medical science and the elevation

¹Dr H H Childs father was Dr Timothy Childs who died 22 years ago was a most prominent man in Berkshire and was a member of many medical societies. In 1824 the year of his resignation as president of the institute he was president of the County Medical Society and at that time helped draw up for the society the following list of charges for the table.

Visit & advice with one mill (medicines & attendance)	\$ 5
At night of mileage	00
Concussion of exclusive of mile fee	5 00
Relieve of the local & medical officers	5 00
General cases	10 00
Amputations	0 00
Trepanning	15 00
Operate on a strangulated hernia	10 00
Extracting and delivery of the placenta	10 00
Use of the forceps or extraction with	0 00
Use of the catheter	0 15
Closing hard p	0 00
Obstetrical cases, in league after the delivery, and a reasonable compensation in the ratio of the fee	4 00

SURGERY

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A STUDY OF BONE REGENERATION

GUSTAV LEVANDER, M D, Koping, Sweden

IN THE healing process of bone the new bone may be pictured as emanating from two different sources: partly from the ends of the bone fragments and partly from the connective tissue surrounding the seat of fracture. In the latter case, the connective tissue is considered transformed into bony tissue by virtue of a special process—the metaplastic theory of bone formation. In the former case, on the other hand, the callus is supposed to be manufactured from specific bone cells which are present in a pre-existing state within the different skeletal layers and which for some reason or another become stimulated into active proliferation—the specific osteoblastic theory.

In strong support of the metaplastic theory we have the fact that we are able to observe directly under the microscope how bone forms in a connective tissue medium without any morphological connection with living bone tissue. Whereas connective tissue is formed in the body in the presence of all sorts of tissue reactions, bone is formed only under special circumstances. Yet the advocates of the metaplastic school have failed to offer any explanation as to why at times connective tissue may in quite a regular fashion be transformed into bone tissue. "*Quelles sont les causes de l'évolution ostéoblastiques des fibro-*

blastes? Personne ne nous le dit" (Leriche and Policard, 1934.)

Among the different skeletal strata, periosteum has of old been ascribed, as is well known, a dominating rôle in bone regeneration. Experiments showing bone formation after transplantation of isolated periosteum into soft tissues have been referred to as the chief proof of this osteogenetic power of periosteum. However, the results of these investigations do not entirely agree with one another. While some authors have found bone to be formed with fairly great regularity, others again have reported large series of experiments in which in no single case bone could be demonstrated. A review of the experience we now possess of free periosteal transplantations, clearly shows that a definite parallelism exists between the results obtained and the anatomical structure of the periosteum under different age periods. As is well known, the periosteum is made up during skeletal growth of two well differentiated layers—an inner one, the cambium layer, which faces the hard bone tissue, and an outer layer, the adventitia, which consists of ordinary connective tissue poor in cells. At the termination of skeletal growth the cambium layer disappears, and the cell deficient adventitia alone remains. All experimental investigations now show that on periosteal transplantation bone formation takes place only in animals the skeletons of which are still

From the Pathological Institute of Uppsala, Sweden, Professor Robin Fahraeus, Chief of Clinic

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

ONE of the most interesting symposiums on cancer held in recent years is reported in *A Symposium on Cancer*¹. The standard of the meeting is indicated by the names of those who contributed to it.

Ewing discusses cancer as a public health problem, he gives a brief history of the development of organized campaigns against cancer and of the development of cancer institutes in this country and abroad. In a survey of the practical importance of biopsy, Ewing discusses extensively the methods and indications for this procedure.

Coutard, under the title "The Reaction of Tissue Cells to Irradiation," gives a brief but comprehensive survey of the effects of x rays on the tissues from a clinical point of view. He discusses the response of the normal squamous cell epithelium of the mucous membrane, the connective and vascular tissues and the response of squamous cell carcinomas to different methods of irradiation and draws important practical conclusions. In a paper on the treatment of cancer of the breast he outlines his views concerning pre-operative and postoperative irradiation of the breast.

In this symposium a large amount of space is devoted to the different phases of research regarding the causative factors of cancer development. Levi Kreyberg contributed two important reports on his genetic experiments (The Genetic and Constitutional Aspects of Spontaneous and Induced Tumors and The Influence of Extrinsic Factors on the Development of Induced Tumors in Animals). C. C. Little reported the latest experiments by him and his co-workers on the influence of intrinsic factors on the development of tumors in mice, with particular emphasis on his later experiments which suggest the importance of extrachromosomal transmission of cancer susceptibility. The human side of cancer genetics is presented by Madge Thurlow Macklin who gives a discussion of the familial incidence of cancer and of chronic irritation and cancer.

The relationship of cancer development to the ovarian hormones is discussed by Edgar Allen. A survey of the chemical relation of the carcinogenic substances producing tumors in laboratory animals.

¹A SYMPOSIUM ON CANCER. Given at an Institute on Cancer Conducted by the Medical School of the University of Wisconsin. Madison: The University of Wisconsin Press, 1935.

is presented by Howard B. Anderson who in a second paper, discusses the effect of biologic products on the growth of malignant tumors. James B. Murphy gives a survey of the present situation regarding the etiologic importance of viruses in their relation to malignant tumors and Warren H. Lewis discusses tissue culture in the study of cancer. Stanley P. Reimann discusses the biology of the cancer cell. Emil Novak presents a clinical treatise on the early recognition and treatment of cancer of the cervix. A most interesting and fundamental discussion on the influence of the wave length on the biologic action of irradiation was given by Gioacchino Failla.

This volume gives a most instructive cross section of almost all phases related to cancer problems discussed by the most competent workers in their respective fields. Unfortunately the delay in publication more than one and one half years after the symposium lessens somewhat the value of this report dealing with a field of such rapid development.

MAX CUTLER

THE first part of *The Heart in Pregnancy*² by Jensen is concerned with the effect of pregnancy upon the normal heart, including a discussion of the increase of cardiac work during pregnancy and mechanism whereby the heart meets the increased demands. The second part is a discussion of abnormal cardiac physiology, particularly the arrhythmias and heart block during pregnancy. The third section covers the field of organic heart disease in pregnancy with emphasis placed upon rheumatic heart disease. Also included are bacterial endocarditis, cardiac syphilis, congenital heart disease, hypertension, coronary disease and the kyphoscoliotic heart. Lastly there is a brief paragraph on hyperthyroidism.

This book is exceptionally well arranged with an extensive and well chosen bibliography. The subject matter of the author and other investigators is clearly presented.

This book deserves a place in the library of every obstetrician and cardiologist. It will also be appreciated by the general practitioner for the practical information it contains.

CHAUNCEY C. MAHER

²THE HEART IN PREGNANCY. By Julius Jensen. Ph.D. M.R.C.S., L.R.C.P. St. Louis: The C. V. Mosby Co., 1935.

Figure 2 shows how bony tissue is being formed in the mesenchymal tissue. Obviously this bone formation can take place even at a certain distance from the graft. Figure 3 shows a detail, which is very highly magnified. The mesenchymal cells can be seen to migrate from all directions toward the bone lamina just being formed—the picture in a way resembling the lines of force that are present in a magnetic field.

RESULTS WITH AUTOGENOUS GRAFTS

In bone grafting, regeneration takes place, according to the specific osteoblastic theory, from young bone cells always said to vegetate on the surface of bone or within the haversian canals. Our knowledge of the structure of the periosteum in adults proves, as already mentioned, that no young bone cells exist between the adventitia of the periosteum and the hard bone tissue. "*En réalité cette couche n'existe pas*" (Leriche and Policard). We have also seen how a superficial layer of bone can be scraped off and how despite this, new bone forms adjacent to such a bone graft. If any bone forming cells were present in the haversian canals one would reasonably expect to find proliferation of bone at this very place, and from their orifices at the surface of the bone one would expect to find the young bone growing out in a broom-like fashion. Such, however, is by no means the case. We can see

how the canals within the graft are empty while new bone is being formed round about it. There are no signs to indicate that fully developed bone cells are able to multiply and to continue to grow after transplantation. It is difficult, therefore, to find any evidence in support of the suggestion that the regenerated bone might emanate from cells belonging to the graft.

The advocates of the metaplastic school ascribe to lime salts an important part in the production of new bone. According to Leriche and Policard we find that "*le transplant a fourni les matériaux calcaires. L'hôte a donné la matrice conjonctive. Dans ce processus, la reprise des cels calcaires est essentielle*." The question may arise, however, as to why lime should be of such importance in the formation of the first primitive bone since tissue calcification is of course not characteristic of bone tissue particularly. All badly nourished tissue is likely to take up lime. It is only in rare exceptions that new bone is found around ordinary calcifications in the body. If we graft a piece of bone that has been previously boiled in water, we get no formation of new bone. Lime does not dissolve on boiling, nor does its chemical composition become altered. Thus we know that the presence of lime does not necessarily lead to the formation of new bone. On the other hand, we know that bone can

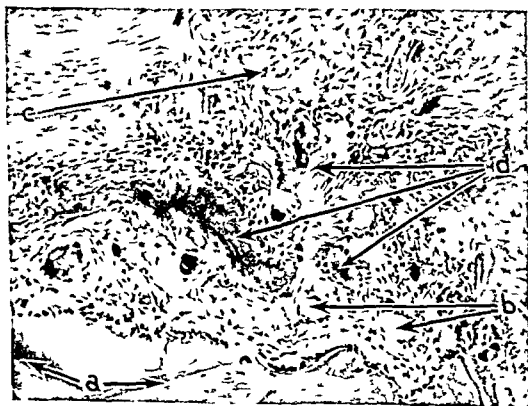


Fig 2 Bone formation around bone graft 15 days old. a, Necrotic bone tissue. b, Vascular lumina. c, Mesenchymal tissue. d, Young bone in process of growth.

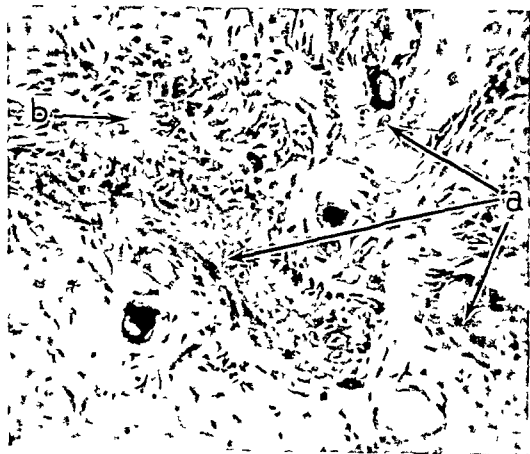


Fig 3 a, Young bone lamina. b, Bone in process of formation. The detail in this photomicrograph is very highly magnified.

in the process of growth. No one has succeeded in getting any bone formation on grafting periosteum into soft structures alone after growth of the bony system has come to an end. Baetzner carried out a series of 57 experiments of that nature on full grown rabbits and did not obtain new bone in a single case. It is obvious that it is only the cambium layer of the growing bone that has the power to stimulate the formation of new bone. Therefore, under such circumstances it is impossible to attribute any general importance to the bone forming capacity of periosteum.

If a piece of fully differentiated, hard, living bone tissue is grafted into a medium of soft tissue new bone always forms. It is clear therefore, that there must be some relation between the newly formed bone and the grafted bone. Since the explanations given in the literature as to the mode of production of new bone on transplantation of hard bone tissue are contradictory I have carried out a few experiments of my own.

EXPERIMENTS WITH AUTOGENOUS GRAFTS

The animals used in these experiments were rabbits. From a piece of bone taken from the middle of the radius or ulna the periosteum was carefully scraped away with a sharp knife and, in addition in about half the animals a superficial layer of bone was removed by a sharp raspator. The bone fragments—as a rule of fairly large size measuring 1 to 1.5 centimeters in length—were implanted either subcutaneously or intramuscularly. Full grown as well as young animals were used and in all of them autoplasmic grafts were

used. In 20 animals the period of observation varied between 2 and 14 days, in 8, between 15 and 30 days. The chief aim with this series of animals was to study at an early stage the tissue reactions which ensue in connection with the grafting of a hard compact piece of bone freed of its periosteum.

A couple of days following transplantation we found lively reaction around the graft. New vessels had formed in abundance and around these was noted considerable proliferation of cells of mesenchymal appearance—so called vascular mesenchyme. Gradually the cells spread in a more uniform manner to create extensive patches of mesenchyme. In some places the mesenchymal cells increased in size and collected in close layers into elongated laminae which subsequently formed into young osteoid seams. These early stages of newly formed bone tissue could be seen as early as 6 days following transplantation. Regenerated bone could be found everywhere around the graft, sometimes in small colonies around one end of the bone, at other times in more or less elongated and thick seams along side the graft in more or less intimate contact therewith. It grew day by day so that as early as 2 or 3 weeks following transplantation as much new bone had been obtained as is on the whole possible to get in experiments of this nature. Occasionally a cartilaginous islet was also seen.

If we follow further the fate of the grafted compact tissue, it will be noted that the bone cells will die off fairly soon. After the fourth day the first signs of diminished vitality will be noticed. The bone design becomes ill defined and the tissue affinity to dyes becomes less marked. The nuclei become matted together into pyknotic clumps and disintegrate or disappear altogether in scattered areas. At the end of about 2 weeks all bone tissue is dead. Nowhere are there any signs of cell division. The haversian canals gradually become somewhat wider than normal but contain no living cells. At these early stages the graft retains its original form entirely and therefore the border demarcating the transition between the lifeless transplanted bone tissue and the surrounding lively cell growth can clearly be seen (fig. 1).



FIG. 1. Bone graft 10 days old. a Necrotic bone tissue. b Haversian canal. c Newly formed bone tissue. d Connective tissue.

of extraction there is no need to pay attention to any special irritant for producing an ossifiable medium of soft tissue

All the injections were made intramuscularly and everywhere auto-extracts were used. All muscles, however, are not equally well suited for the injections. Naturally such muscles should be avoided which are in widespread contact with bone since ossification is well known to occur in such muscular groups, for instance after trauma, without any exogenous irritant having been added. It is my opinion that the rectus femoris is a muscle exceedingly well adapted for these experiments. This elongated muscle passing by means of a tendon into the patella is thus in no direct contact with bone in its distal part. In its proximal part, too, it becomes attached to the pelvic parts mainly by means of tendons. On injections into the distal parts of this muscle, it can surely be taken for granted that no bone cell could become dislodged from its origin at the pelvis and be conveyed along almost the whole length of the muscle to the site of injection. Moreover, the muscle is all along surrounded by a sheath of aponeurosis. Through this capsule, as also through the surrounding powerful muscles, the rectus is well separated from the femur. It is exceedingly unlikely then that the tissue reaction taking place in this muscle could be affected in any appreciable degree by any lymph currents from the skeleton. The fact that the whole length of this narrow muscle is surrounded by a connective tissue sheath may possibly have another effect, namely, that of preventing the injected fluid from spreading over large surfaces and becoming rapidly absorbed, it is instead held back and thus the tissue reaction continues for a longer period of time.

Experiments with alcoholic extracts of bone and callus, 60 tests As it seemed likely that some bone forming substance would be present in particularly abundant quantities as well as in an active form at the seat of fracture, experiments were first carried out with extracts from bone as well as from callus tissue. One of the forearms had been previously fractured, and amputation just above the elbow was carried out 5 to 10 days later. The soft structures of the amputated specimen

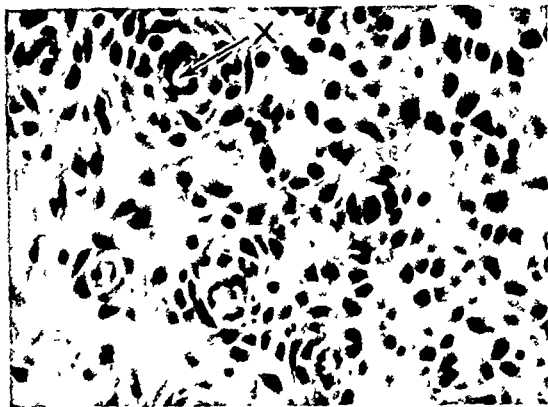


Fig 5 Vascular mesenchyme, highly magnified

thus obtained were removed and all bone tissue of the forearm was macerated into tiny fragments and mixed with the finely cut up callus and bone marrow into a mash which was immediately put into a tube containing 10 to 15 cubic centimeters of absolute alcohol. The extracts were kept in a thermostat at a temperature of 40 degrees C with the view to facilitate the dissolving of the substance. The first injection was made the day after the preparation of the extract. With a fine needle 2 cubic centimeters of the supernatant portion of the clear extract was sucked up into the syringe. In some instances the absence of cells was checked by centrifugalizing the aspirated extract and by microscopic examination of the sediment. To avoid too pronounced a necrosis at the seat of injection the extract was diluted with saline solution until an alcoholic solution of about 40 per cent was obtained. Three to 5 cubic centimeters of this solution was injected into the distal end of the rectus femoris. In all 3 to 4 injections were made in each animal at intervals of, as a rule, 2 days. The period of observation varied between 2 weeks and 2 months—in most cases it extended over a period of 1½ months. At autopsy, the distal half of the rectus femoris was removed for microscopic examination. In all, 60 tests with injection of alcoholic extract were carried out. In 14 instances we found more or less extensive formation of cartilage or bone.

Figure 6 shows a preparation containing cartilaginous tissue in specimen removed 45 days after injection. The cartilage is every-



Fig 4 Vascular mesenchyme

form without lime being present, as for instance in ossification of lime deficient cartilaginous tissue

With the morphological analysis of tissue reactions in bone grafting as a basis it would seem that another explanation of the production of new bone is called for. As already observed, new bone is formed directly out of the mesenchymal tissue which surrounds the graft. For such differentiation to take place in non specific tissue must necessarily show that the process is influenced in some way or another by some specific agent. Since there is every reason to believe that some connection exists between the grafted bone and the new bone tissue laid down it is reasonable to assume that the specific stimulus needed by the mesenchymal tissue emanated from the graft itself. Therefore it occurred to me that this stimulating agent might possibly be transferred from the graft to the surrounding areas in the form of some substance that is soluble in the tissue lymph. When the bone graft is transplanted this specifically bone forming substance is liberated from the bone tissue and is carried by the tissue lymph to the surrounding areas where it is able to activate the mesenchymal tissue in such a way that this becomes differentiated into bone tissue—either directly or by means of the embryonic pre existing stage of bone and cartilaginous tissue

EXPERIMENTS WITH EXTRACTS

In the hope of discovering the presence of a substance with bone forming properties the author carried out a few experiments for extracting this substance from bone tissue and then injecting the extract into a medium of soft tissue

Since we have no knowledge of the chemical properties of this hypothetical substance it is naturally difficult to decide upon the most suitable solvent. In the first series of experiments aqueous extracts were used and no experiments gave negative results. I then resorted to alcoholic extracts. Rabbits were used as experimental animals.

Before these experiments are attempted it is of course essential that the tissue selected for injection can be transformed into bone tissue. The injections must therefore be done in a medium containing young undifferentiated cells of mesenchymal origin. On repeated injections of 40 per cent alcohol into soft parts I found that a great abundance of mesenchymal tissue formed at the seat of injection. Figure 4 is a low power photomicrograph of such a mesenchymal field. The tissue is very rich in vessels and cells. The vessels are made up of capillaries, all of which according to the sectional direction present a rounded or more oblong appearance. The cells are either clustered together around the vascular lumina or are more sparingly scattered about in the lighter zones between the vessels. On greater magnification the grouping of the cells around the vessels can be studied (Fig 5). At the section has struck a vessel at right angles. Its lumen is bounded by 3 to 4 endothelial cells and from these concentric layers of cells of a similar appearance extend into the surrounding areas. The cell increase in size from the center to the periphery. Still farther away from the center, large cells can be seen with massive powerfully stained nuclei. As a rule the cells are triangular in shape with one of the borders often drawn out into a long point—a typical appearance of mesenchymal cells. The impression given by these pictures is that the fully formed mesenchymal cells ultimately emanate from the endothelial cells of the capillaries. When alcohol is used as a means

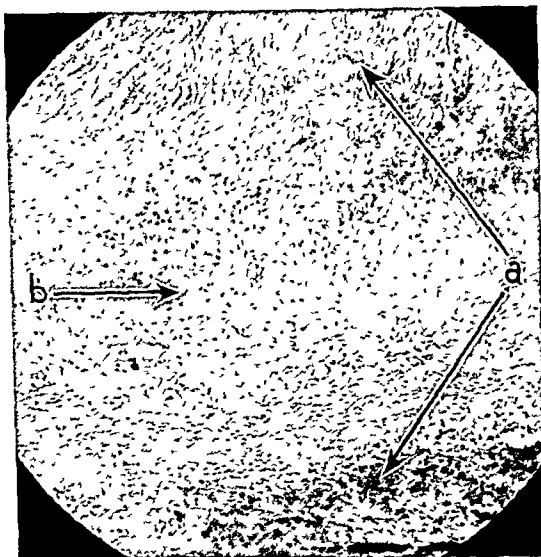


Fig 9 Formation of cartilage. *a*, Mesenchyme
b, Cartilage

early as 4 days after the fracture occurred—it was of interest to study the reaction fairly soon after the injections were made. The period of observation in these experiments was therefore a brief one—not exceeding 12 days. In 2, cartilage was obtained the appearance of which was interesting from a histogenetic point of view. These preparations were obtained as follows: May 17, amputation and preparation of extracts. The mash from the two forearms was divided into 3 parts and each part was placed in a retort containing 7 cubic centimeters of acidified 95 per cent alcoholic solution (190 cubic centimeters of absolute alcohol and 10 cubic centimeters of 0.2 per cent hydrochloric acid). The extracts were kept cold at 0 degrees C. Five cubic centimeters of a 40 per cent extract were injected on May 19, 21, and 23, respectively. The specimen was prepared on May 31 (Figs 9, 10, and 11).

Figure 9 shows a general view of cartilaginous tissue undergoing formation. From both sides the mesenchymal tissue can be seen growing in toward the central longitudinal cartilage plate. In Figure 10 this transformation of the mesenchymal tissue into cartilage can be seen in greater magnification. In the

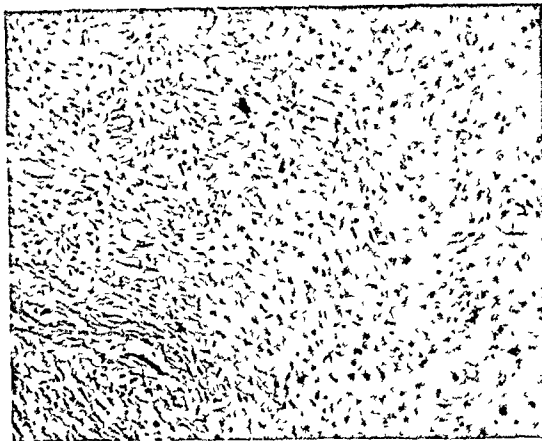


Fig 10 Cartilage in formation, highly magnified

original mesenchymal tissue with its stellate cells and wide interstices the mass of protoplasm is magnified around the nuclei—endoplasm—and the anastomotic outshoots become short and thick. The endoplasm assumes a granular appearance and passes into the more homogeneous so called exoplasm, of a faintly fibrillar structure. The interstices disappear and the exoplasm from the various cells becomes intimately bound up with a coherent mass of protoplasm of a clearly hyaline appearance in which the nuclei are embedded, surrounded by a lighter zone of endoplasm. Figure 11 shows a greater quantity of such fully developed cartilaginous



Fig 11 Cartilage, completed



Fig 6 Cartilaginous tissue

where of hyaline appearance. In this general view the cartilage can be seen growing in a diffuse manner infiltrating the musculature. The separated muscle fibers can be seen in more or less elongated strands with their vitality maintained. Cartilage and muscular tissue are everywhere sharply defined from one another. At the periphery the cartilage passes into cellular tissue which gradually merges into ordinary cell deficient connective tissue. There is no capsule separating the cartilage tissue from the surrounding areas.

Figure 7 shows a preparation with a cartilage islet the center of which is on the point of being transformed into bone tissue.



Fig 7 Cartilage passing into spongy bone

The specimen was obtained 60 days after injection. In those zones where the cartilage is being liquefied the cartilage cells become somewhat larger, and assume a more vesicular appearance because endoplasm increases in size at the expense of exoplasm. Numerous capillaries extend into these zones of liquefaction surrounded by mesenchymal cells. Gradually the cartilage disintegrates and becomes a tissue made up of capillaries surrounded by mesenchymal stellate cells. Young osseous laminae are then differentiated from this vascular mesenchyma.

Figure 8 shows a piece of spongy bone tissue obtained 30 days after injection. The bone fragment is located in the musculature surrounded on both sides by a thin layer of connective tissue poor in cells. There is no cartilage in this preparation. The bone tissue has therefore been differentiated directly from the mesenchymal tissue. The nuclei are well stained and the bone structure is sharply defined which indicates good vitality.

Experiments with alcoholic extracts of bone tissue 10 tests. In this series the extracts were prepared from normal bone tissue. We used slightly acidified alcohol in concentrations of between 70 and 95 per cent as the extract agent. The same technique was employed as in the previous series. Since for example in bone grafting or in the case of fracture new bone forms at a very early stage—in fracture, the formation of new bone may be observed as



Fig 8 Spongy bone tissue

bone formation is of great interest for the reason, among others, that it is the only form of new bone we are able to produce without using material from the living skeletal tissues. For certain reasons I maintain that also in this location some specific substance causes bone formation. It is well known how a number of hormones are excreted with the urine, such as folliculin, prolan, etc. These substances have the power of activating different tissues and causing them to become differentiated in certain directions. By analogy there is every reason to assume that a bone forming substance, too, can be excreted with the urine.

In assuming that some specific bone forming substance is excreted by the kidneys, it must also be taken for granted that such a substance is present in the circulating blood, a fact which probably explains the different locations of heteroplastic bone formation. Therefore, according to this hypothesis, wherever some ossifiable medium arises in the form of young non-specific mesenchymal tissue in conjunction with some vascular lesion allowing the substance to escape from the blood stream, there is reason to expect the formation of new bone.

It is my belief that my theory permits of a uniform explanation for all the different forms of bone regeneration encountered in the adult organism. However, it would be desirable to find a certain measure of agreement between this theory of bone formation and the manner in which bone tissue is laid down during the embryonic stage of development. In conclusion, therefore, it may be of interest to refer to the recent view advanced by Spemann on the differentiation of embryonic tissues. His ingenious micro-surgical experiments of isolation and transplantation have shown how untenable is the old theory of pre-existing layers. By the re-shifting of cell material Spemann has been able to show that some of the transplanted cells are able to alter their character and develop in conformity with the conditions prevailing in their new environment. On the other hand, he found that definite regions were decisive for the development—so called organization centers. By transplanting an organizer of that nature, Spemann was further able to show how the surrounding tissue in the

new medium is forced to follow the development of the organizer—a phenomenon to which he has given the name of induction. This inductive activity is considered to be caused by definite chemical substances that have the power of differentiating non-specific cell material in a certain direction. It is clear, therefore, that the most recent investigations into embryonic differentiation entirely coincide in their main principles with the view advanced by the author in this paper regarding the mode of origin of regenerated bone in the fully grown organism.

SUMMARY AND CONCLUSIONS

1 According to present theories, regeneration of bone may take place either from pre-existing cells belonging to the different skeletal layers—the specific osteoblastic theory—or as a result of transformation of non-specific connective tissue—the metaplastic theory.

2 The metaplastic theory advances no reason for the transformation of connective tissue into bone tissue.

3 According to the specific osteoblastic theory, periosteum plays a dominating part in the regeneration of bone. Experimental experience, however, has shown that it is only the periosteum of the growing skeleton that has the power to stimulate the formation of bone. On the other hand, when fully differentiated hard bone tissue is grafted, new bone is always formed.

4 In a series of experiments the author has studied more closely the mode of origin of new bone after transplanting into soft parts hard bone tissue stripped of periosteum. Morphological analysis of the tissue reactions in these experiments shows that new bone tissue is formed from the mesenchymal tissue in the areas surrounding the graft. The specific stimulus necessary for the formation of new bone is brought to the mesenchyme, according to the author's opinion, in the form of a substance liberated from the graft and conveyed with the lymph into the surrounding areas.

5 In a second series of tests the author experimented with bone tissue extracts injected into soft structures. With the use of alcoholic extracts he found in 22 per cent of 70

tissue arising from a different place in the same preparation

Controls, 80 tests By methods identical to those employed in the preceding series of experiments alcoholic solutions were then injected into 60 controls the solutions being of the same concentrations and of the same quantities as in the extract tests. In 20 cases extracts of connective tissue, striated and smooth musculature were also injected by the same method. Microscopic examination disclosed in all the cases an exceedingly great abundance of newly formed connective tissue in various stages of development but never either cartilage or bone

RESULTS IN INJECTION EXPERIMENTS

In 22 per cent of 70 animals receiving intramuscular injections of alcoholic extracts of bone and callus tissue cartilage or bone formed. In 10, an aqueous extract of bone tissue caused the formation of no cartilage or bone at the seat of injection. In view of the extract agent employed it stands to reason that the cartilage and bone obtained cannot be the result of proliferation of living osteoblasts accompanying the injections. Moreover the method employed would prevent osteoblasts from traveling from the periosteum of the femur to the seat of ossification in the rectus femoris. Besides it will also be noticed that the cartilaginous tissue is directly differentiated from the mesenchymal tissue newly formed in the musculature (Fig 10). Naturally a process of that nature cannot take place unless aided by some specific stimulating agent that affects the initially non specific mesenchyme. Since no new bone was formed in the controls it is clear that this specific factor does not appear at just any kind of tissue reaction that takes place in the musculature

If for this reason conclude that the specific stimulus in those cases in which cartilage or bone forms is added in the form of some substance extracted by alcohol from the skeletal tissue, a substance having the power to activate the non specific mesenchymal tissue into the formation of bone tissue either directly or via the embryonic primitive stage of bone, viz, cartilage

By assuming the presence in bone tissue of a substance with bone forming properties new bone formation in immediate connection with the skeleton can be explained. As is well known, however, bone forms in the completed organism also in sites more or less distant from the skeleton—so called heteroplastic bone formation. Naturally it would be desirable to attribute to a common principle the mode of origin of all new bone formation, no matter what its anatomical location. As is well known bone can form in almost any organ or tissue. Usually these findings are generally regarded as rare curiosities for example bone formation in a nerve in a lymph node, in the heart the auricle, etc. Two manifestations of heteroplastic bone formation are relatively common, however it is a common experience for example, to find ossification in muscles after one or several injuries have been sustained. We know how such muscular ossification almost exclusively affects the muscles that are as already mentioned, extensively connected with the skeleton. All these muscles pass at their origins or insertions directly into the bone tissue without the agency of any intervening periosteal connective tissue membrane. Lever lays special stress on this anatomical relationship between muscle and skeleton and maintains that thereby the specific osteoblasts are able without hindrance from any membrane to wander out into the muscle, there to establish centers of ossification. As stated earlier however, the periosteal cambium layer is absent in adults and ossification areas in muscles may be met with in all ages. In my opinion therefore it is more reasonable to assume in cases of trauma that some bone forming substance is liberated from the surface of the bone tissue and transferred by the tissue lymph to the surrounding musculature. In the mesenchymal tissue re-actively formed around the traumatic foci of contusion in the musculature the bone forming substance encounters a suitable soil which lends itself well to being differentiated into cartilage or bone tissue

By various experimental methods e.g. ligation of renal vessels we are able with great regularity to produce ossification along the different sections of the urinary tract. This

THE MODE OF INCEPTION AND LATERAL SPREAD OF CERTAIN SQUAMOUS CELL CARCINOMAS

A Histopathologic and Experimental Study

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MICROSCOPIC study of small and early squamous cell carcinomas and of the so called precancerous lesions of the skin and buccopharyngeal mucosa reveals that the processes involve a segment of the epithelium and that they are not the result of changes arising in one cell or a small nidus of cells (Fig 1) At the margins of such lesions are zones of direct continuity between normal and abnormal epithelium, and in such zones it is not possible by present staining methods to distinguish which cells are normal and which are neoplastic Thus, such types of carcinoma appear to be segmental in origin The appearance, in some of the well established carcinomas, of long adjacent parallel columns of cells proliferating downward from a rather thin superficial segment also affords evidence of a segmental origin of the lesion (Fig 2)

Microscopic examination of the margins of a well established carcinoma may reveal one of several conditions (1) A zone of direct continuity between malignant and normal epithelium with, in some instances, an interposed zone of hyperplasia (Fig 3) (2) A distinct break between normal and malignant epithelium with the former pushed upward by infiltration of carcinoma beneath it (Fig 4) (3) A raised rolled border of normal epithelium with a zone of direct continuity on its inner (toward the carcinoma) aspect (Fig 5) (4) A "break" at the periphery of the lesion with cells streaming downward from the very margin of the normal epithelium, cells which appear to be undergoing carcinomatous de-

generation and the change of which into carcinoma apparently contributes to the adjacent process (Fig 6) (5) A zone of continuity between malignant and non-malignant epithelium but in which the morphologic difference between cancerous and normal cells can readily be appreciated If multiple sections are made in different vertical planes of a given lesion, any or all of the above conditions may obtain in various segments of the margin

Of special interest is the finding of the zones of continuity between cancerous and non-cancerous epithelium at the margins of the lesions which from the clinical history began as small processes and increased in size If the lateral spread of such lesions were due to infiltration of the malignant epithelium into the surrounding normal epithelium it should be readily appreciated on microscopic study Small masses of malignant cells could be seen burrowing between the normal cells affording a picture quite similar to that seen in Paget's carcinoma of the nipple Furthermore, when a carcinoma other than of cutaneous origin involves the skin there is no difficulty in distinguishing the small masses of cancer cells in the layer of squamous epithelium, pushing apart the normal cells of the latter (Fig 7)

It would appear that the zones of continuity referred to above in the well established skin or mucosal carcinomas are best explained by the hypothesis of progressive cancerization of the normal epithelium at the margins of the initially altered segment, i e , the cancer at its inception When a break in the continuity of malignant and non-malignant epithelium is present, it might be assumed that the lateral spread was due entirely to centrifugal pressure of the growth, the result of multiplication of its cells, and that such growth was too rapid to permit of the opportunity of peripheral can-

From the Department of Surgery and the Division of Roentgenology of the Department of Medicine of the University of Chicago

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animals the formation of cartilage or bone at the seat of injection. In a series of 80 controls with injections of alcohol alone or alcoholic extracts of other tissues there was no formation of cartilage or bone.

6. On the basis of these experiments the author holds that bone regeneration takes place as the result of some specific bone forming substance activating the non-specific mesenchymal tissue. According to this theory the mode of origin of heteroplastic bone formation is also afforded a likely explanation. The theory also agrees with the views ad-

vanced by Spemann with regard to the embryonic development.

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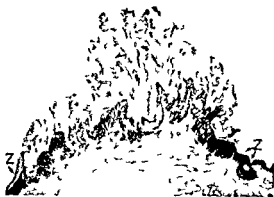


Fig 1 Photomicrograph of precancerous lesion of skin. Note that the initial changes occur over a segment of epithelium. Z Zones of direct continuity with normal epithelium at margins of lesion where accurate differentiation of cells of lesion and normal cells can not be made. X6

cerization or that the normal epithelium about a small lesion at its inception is as highly resistant to cancerous degeneration.

This hypothesis of progressive cancerization as a factor in lateral spread of such lesions is of course not a new one, but does not seem to have received much emphasis in the literature. Ribbert in his classical treatise on human carcinoma admitted the morphologic evidence for the hypothesis but rejected it as highly improbable. More recently I wing in his text says "Carcinomas arising from misplaced and embryonic cells are isolated from their inception, probably remain so through-



Fig 3 Photomicrograph through margin of squamous cell carcinoma showing zone of continuity between C cancerous and N normal epithelium. In this zone of continuity it is not possible to differentiate carcinomatous and non-carcinomatous cells. X43



Fig 2 Photomicrograph of squamous cell carcinoma of skin showing downgrowth of epithelial cell masses (like stalactite) from superficial layer of epithelium—further histologic evidence of segmental origin of such lesions. X9

out their history and illustrate in the purest form the principle that tumors grow from their own resources and not by progressive transformation of normal into tumor cells. Equally important with this principle so strongly urged by Ribbert, is the fact that many carcinomas during the period of their inception and for some portion of their early growth involve increasing areas of glands or mucous surfaces in their points of origin and thus extend in part by gradual transformation of previously normal cells.

In our experiments presented below, squamous cell carcinomas were induced in 60 to 90 days on the backs of white mice by triweekly applications of a 0.3 per cent methylcholanthrene solution in benzene.



Fig 4 Photomicrograph of a specimen showing the margin of a squamous cell carcinoma where there is a distinct break between the non-neoplastic epithelium N and the carcinoma C which is infiltrating beneath the former. X105

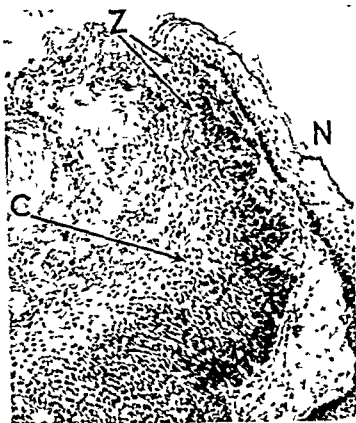


Fig 5 Photomicrograph showing "raised rolled border" of squamous cell carcinoma. N, Normal epithelium; C, Carcinoma. Zone of continuity, Z, between the two in which malignant and non-malignant cells are not distinguished, one from the other $\times 85$

Multiple discrete lesions appeared in the treated areas. At first they were small sessile warts, which increased in size, ulcerated in the centers, and later acquired a typical gross appearance of squamous cell carcinoma. Microscopic study of the small lesions revealed an appearance similar to that of the small precancerous and cancerous lesions in man—a definite segmental origin was readily apparent (Fig 8). Microscopic study of the margins of the larger growths showed the same variety of conditions as seen in the human lesions, i.e., zones of continuity in which normal and neoplastic cells cannot be differentiated, areas in which there was a definite break between the normal and neoplastic epithelium, etc.

Experiment 1 (Fig 9). A well defined early lesion was chosen from among several on the backs of each animal. By means of a hypodermic needle gauge 27 India ink dots were tattooed in a circle through the normal skin into the subcutaneous tissues about the lesion approximately 1 millimeter or more from its edges and the diameter of the circle was noted. Application of the carcinogenic substance was discontinued and the lesions were inspected daily. Of a larger series 14 animals were suitable for consideration. In 6 the lesions appeared to become stationary, or regress completely following the tattooing while other surrounding lesions continued to grow. In 2 the lesions continued to increase in size, infiltrating beneath the tattooed dots and compressing these outward so that they had the appearance of radiating spokes over the margins of the growth. Microscopic examination revealed a definite break between the



Fig 6 Photomicrograph showing margin of squamous cell carcinoma where cells from the edge of the receding normal epithelium appear to be undergoing carcinomatous degeneration, CX, and streaming downward into the lesion, C, appear to contribute to it $\times 100$

normal and neoplastic epithelium at the margins of the growth—the latter appearing to have spread laterally and by centrifugal pressure, pushing the edges of normal epithelium outward and undermining them (Fig 10). In 6 instances the lesions overgrew the circle of dots that was in the subcutaneous tissue so that the latter were hardly or not at all visible due to the thickness of the lesion over them. At necropsy when the skin and subcutaneous tissues were reflected the circle of dots was again noted from beneath and the diameter observed to be the same as previously, i.e., the expanding carcinoma did not push the dots outward but grew over them (Fig 11).

Microscopic examination of the borders of these lesions revealed in some planes a zone of direct continuity between neoplastic and non-neoplastic



Fig 7 Photomicrograph showing infiltration of squamous epithelium of skin by cords of breast carcinoma cells, B. Such a picture is not seen in normal epithelium about squamous cell carcinomas of the skin or buccopharyngeal mucosa. It would thus appear that such type of lateral spread in these lesions does not occur $\times 180$



Fig 8 Photomicrograph of beginning squamous cell carcinoma of skin of mouse back produced by application of methylcholanthrene. Note segmental origin of lesion with zones of direct continuity between cancerous and non-neoplastic epithelium Z and Z' X 6

epithelium where a differentiation of neoplastic and non-neoplastic cells was not possible. Such zones were situated directly over or beyond (outward) the ink spots which at the time of insertion were made through normal overlying skin. In 1 case one margin showed a break in continuity while at the opposite margin the receding edge of normal epithelium appeared to be the site of origin of cords of cells which were streaming downward to become continuous with the masses of frankly malignant cells infiltrating the subjacent connective tissue.

In the cases described in the preceding paragraph the lateral shift of a zone of direct continuity from within the circle of dots to a position over or outside this circle appears best explained in our opinion by the hypothesis of progressive cancerization of normal epithelium as a factor contributing to the lateral spread of the lesions. As mentioned in discussion of the human lesions, no evidence of infiltration of the normal epithelium by cords of malignant squamous cells could be detected.

If it is assumed that such progressive cancerization occurs at the periphery of the lesion it must likewise be assumed that this normal epithelium possesses a certain degree of susceptibility to malignant degeneration under influence of, among other things, factors identified with the already developed carcinoma. The fact that when a large skin surface is exposed to a carcinogenic agent the lesions are multiple, scattered and discrete, indicates that in such surfaces there are regions of hypersusceptibility to carcinomatous degeneration surrounded by or alternating with regions which are less sensitive to such changes. When application of the carcinogenic compound has been made for some time and the multiple lesions have for the most part be-

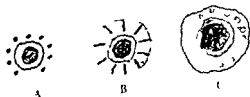
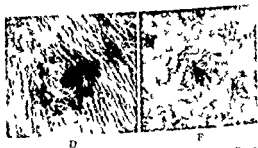


Fig 9 Diagrammatic representation of Experiment 1 see text. A Small carcinoma about which a circle of dots has been tattooed. B When the carcinoma grows entirely by expansion the tattooed dots are compressed outward. C When the lateral spread of the lesion has presumably been by cancerization of surrounding normal epithelium the dots are obscured by thickness of the lesion over them.



they have not been compressed laterally. D Small carcinoma on mouse's back about which a circle of India ink dots has been tattooed. E Same lesion after 14 days have elapsed. The carcinoma has spread laterally to grow over the circle of dots, the latter being in the subcutaneous tissue. New lesions have made their appearance in the surrounding skin.



Fig 10 Photomicrograph through experimental carcinoma on back of mouse which grew laterally as indicated in 9, B, by proliferation of its cells and centrifugal pressure. There is a break between carcinomatous and normal epithelium, B. The dark curved zone, T, consists of the tattooed dot (India ink particles in macrophages) pushed laterally and compressed by expansile growth of the lesion.



Fig 11 Photomicrograph of margin of experimental carcinoma on mouse's back which spread laterally as indicated in Fig 9, C. Z, Zone of continuity between lesion and surrounding hyperplastic epithelium in which malignant and non-malignant cells cannot be differentiated. T, Tattooed dot which was inserted through normal skin overlying it at the time. In its lateral spread, a contributing factor was progressive cancerization of normal epithelium. This picture corresponds fairly closely to that seen in certain human lesions as shown in Figure 3. $\times 63$.

come well established and spreading carcinomas, those regions of the skin which have not developed lesions may be regarded as highly resistant to such changes. Thus it may be argued that if such a segment of resistant epithelium were apposed to a carcinoma and that even though it healed by continuity with the lesion, extension of the carcinomatous process to involve the epithelium of such a segment should not occur. Experiments along these lines were conducted as follows:

Experiment 2 (Fig 13) Well developed carcinomas were bisected and one-half of them together with an adjacent portion of normal skin removed. The wounds thus created were sutured by interrupted fine silk. One edge of them consisted of a freshened carcinoma, the other a freshened non-neoplastic skin. After a few days when healing was apparent a line of India ink dots was tattooed about 1 to 2 millimeters from the wound margin in the normal skin in order to serve as a marker for evidence of extension into the skin of carcinoma from the opposite edge.

In 3 cases complete healing did not occur, the wounds spread leaving a granulating base. The carcinomatous edge did not appear to proliferate over this ulcer nor did normal epithelium from the opposite edge after periods of 10, 12, and 38 days, respectively, after the wound separated. In 4 cases the remaining half of the carcinoma regressed during

periods of 7, 10, 27, and 29 days, respectively, leaving healed, normal appearing surfaces. In 7 cases healing of the wounds appeared *per primam* and the carcinomas continued to spread laterally away from the sutured line. The edge at the sutured line, however, became a typical "raised rolled edge" and the lesion did not appear to be able to extend across it to involve the newly apposed skin but seemed to be halted at the healed sutured line, while infiltration of the cancer into the subepithelial connective tissue did occur (producing the pronounced "raised rolled edge" mentioned). This last series of animals died or were killed 16, 16, 23, 25, 26, 26, and 27 days, respectively, after operation, and microscopic sec-



Fig 12 Photomicrograph through margin of experimental carcinoma which spread laterally as shown in Fig 9, C. T, Tattooed dot which at time of insertion was made through normal skin. The receding margin of non-neoplastic epithelium, N, appears to be giving rise to carcinoma cells which stream downward to contribute to the lesion, C. This picture corresponds closely to that seen in certain human lesions as shown in Figure 6. $\times 68$.

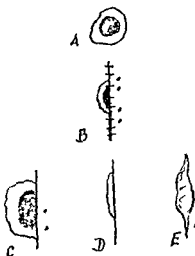


Fig 13 Diagrammatic representation of Experiment 2. Carcinoma A was bisected and non neoplastic skin sutured to it. A row of dots was tattooed along the wound margin in the apposed flap B. In some cases the lesion grew away from the wound, the latter healed but the lesion did not cross the wound line C. In other cases the wound healed but the carcinoma partially or completely regressed D. In still other instances wounds separated leaving chronic ulcers over which neither neoplastic or non neoplastic epithelium spread E.

tions were made in several planes in right angles to the old healed wound. Microscopic study (Figs 14 and 15) revealed that in every instance healing of the apposed normal epithelium to carcinoma had occurred resulting in a zone of direct continuity be-

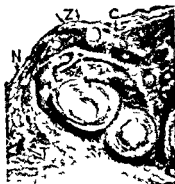


Fig 15 Photomicrograph of healed wound produced according to experiment as shown in Figure 13. C 25 days after suture. T Tattooed dot made in normal skin flap. Z Zone of continuity between normal skin A and carcinoma C. The latter tends to infiltrate the subcutaneous tissues of the flap but does not involve the skin of the flap although it has healed by direct continuity with it. X39.



Fig 14 Photomicrograph of healed wound (6 days) made by suturing bisected carcinoma to normal skin flap. T Tattooed dot placed through normal skin. Z Zone of continuity between carcinoma C and normal skin. The carcinoma did not extend to involve epithelium of flap although the opposite margin extended several millimeters away from the wound as shown in Figure 13. X55.

tween the two. There was no visible mechanical barrier to opposite extension of the malignant epithelium into the apposed flap epithelium, yet as stated it did not occur. Infiltration in the subcutaneous tissue of the apposed edge of normal skin by a centrifugal extension of the mass of cancer cells did on the other hand occur as could readily be appreciated by the general appearance of the sections and the relationship of the malignant cell masses to the tattooed dots. Microscopic study of the border of the carcinomas which lay away from the sutured wound showed extension by progressive cancerization. This contrast of the two edges of the carcinoma, one in which the adjacent skin appears to be contributing to lateral spread of the lesion by its own progressive cancerization and the other in which the adjacent normal epithelium is not involved at all and in which what little lateral spread occurs is entirely due to centrifugal pressure and subcutaneous infiltration of the cancer cell mass is quite striking.

The above findings are interpreted to indicate that since the flap of normal skin had been exposed to the carcinogenic substance as well as other regions of the back and did not develop a lesion it was highly resistant to cancerous degeneration and that when apposed to an already existing cancer and even though it healed by continuity with the malignant epithelium it was not converted into cancer.

because of its natural high resistance to such a change

Skin or buccopharyngeal carcinomas are observed in man which seem to arise from a limited segment of epithelium. Sections through the margins of these growths reveal the zones of continuity as described. However, the principle growth of the lesion appears to take the form of a downward proliferation and a lateral proliferation beneath the surrounding normal skin elevating the latter to form a raised rolled border. The latter experiment performed above would suggest that in such cases the surrounding epithelium is highly resistant to cancerous degeneration and the small zone of junction between normal and malignant epithelium is a relatively fixed point. The latter feature is apparently well illustrated where this junctional zone appears to have been carried outward and under a rolled raised margin due to sheer centrifugal force exerted by an expanding lesion (Fig 16)

EVALUATION OF STUDY

Little can be said about the nature of the factors which might induce progressive cancerization at the periphery of an established carcinoma, but they would appear to be identified with the already established lesion or they might well be the continued operation of the factors which led to formation of the initial lesion.

What has been said in the preceding paragraph applies, as stated, to studies made upon cutaneous and buccopharyngeal carcinoma. No studies were made upon carcinomas that arise in the mucosa of the stomach and the bowel, etc.

The statements made also cannot be applied to squamous cell carcinoma of the cervix since malignant tumors in this small region afford a special biologic problem of their own.

In conclusion, attention may be called to the apparent high degree of fragility of the experimental carcinoma to mechanical injury since an appreciable number of the lesions partially or completely regressed after the procedures outlined were carried out. The



Fig 16 Photomicrograph of squamous cell carcinoma of ear (human). C, Carcinoma. N, Hyperplastic skin. Z, Zone of continuity between non-neoplastic skin and carcinomatous epithelium. Detailed explanation in text. $\times 11$

reason for this is not clear, and whether such regressions might be explained on the basis of local mobilization of macrophages as a result of the trauma cannot be gone into here. Certainly comparable human lesions at least do not exhibit such a high incidence of fragility. On the other hand, the clinical cures occasionally observed following what would be regarded as inadequate local excision or cauterization suggest that some of them might be quite susceptible to trauma.

SUMMARY

1 The hypothesis of progressive cancerization of normal epithelium in the immediate periphery of certain squamous cell carcinomas as a factor (in addition to centrifugal expansion of the lesion because of multiplication of its cells) in the continued lateral spread of such lesions is studied experimentally for the first time. Histologic comparisons with human carcinomas are made. The results are interpreted by the authors as furnishing additional support for this hypothesis.

2 An incidental observation upon the squamous cell carcinomas experimentally induced by methylcholanthrene in mice is the high incidence of marked fragility to mechanical trauma directed to the lesion or to its immediate vicinity.

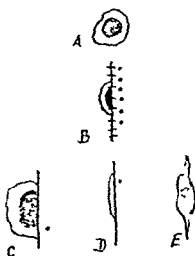


Fig. 13. Diagrammatic representation of Experiment 2. Carcinoma. A was bisected and non-neoplastic skin sutured to it. A row of dots was tattooed along the wound margin in the apposed flap. P. In some cases the lesion grew away from the wound, the latter healed but the lesion did not cross the wound line. C. In other cases the wound healed but the carcinoma partially or completely regressed. D. In still other instances wounds separated leaving chronic ulcers over which neither neoplastic or non-neoplastic epithelium spread. E.

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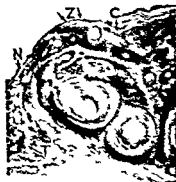


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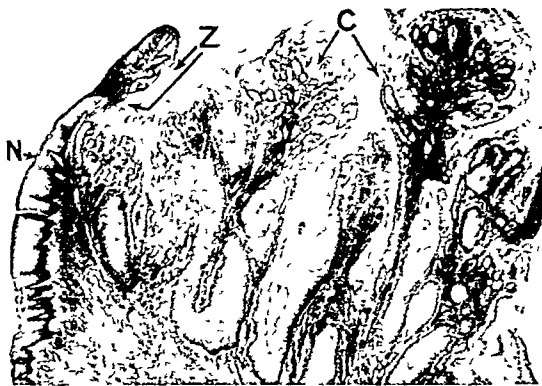


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NEURITIS OF THE BRACHIAL PLEXUS MECHANICAL IN ORIGIN

The Scalenus Syndrome

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THE scalenus syndrome is assuming progressively greater importance in the diagnosis of pain in the upper extremity. The present study is a review of the cases of 18 patients operated on in this clinic during the past 9 years, for complaints suggestive of cervical rib. On x-ray examination however these patients had either no evidence at all of cervical rib, or no more than a small outgrowth which of itself was too insignificant to account for the symptoms, or even to require removal at operation. For this group we have applied the term 'scalenus syndrome'.

In 1903 Bramwell attributed symptoms in such patients to pressure caused by a normal first dorsal rib. Murphy, in 1906 first drew attention to the anterior scalenus muscle as a factor in the production of symptoms arising from cervical rib. He showed that the cervical rib in carrying the brachial plexus and subclavian artery forward pressed these structures against the anterior scalenus muscle and he advanced the idea that this muscle was essential to the production of symptoms.

In 1913 Morley described a case and added supraclavicular tenderness to the list of signs. Two years later Outland and Clendening reported a similar case but made no significant comments. In 1919 Stopford and Telford reviewed 10 cases and observed that the loss of protopathic sensation was greater than that of epicritic sensation as had been noted by Charcot in 1892. In treatment Stopford and Telford removed part of the first rib and divided the anterior scalenus muscle incompletely with entirely satisfactory results. In the following year Wheeler reported 2 cases treated successfully by resection of the first

rib. In 1921, Bramwell and Dyles published a study of 23 patients with the clinical picture of cervical rib. At least 6 however, had no such supernumerary rib. Tenderness usually was present over the seventh cervical transverse process.

Brickner and Milch reviewed the literature in 1925, and added 1 case. They found references to the condition by Hvoslef, Szawicki and Clerc. Hvoslef thought that there was an abnormal connection between the first and second ribs in his patient. Szawicki had 1 case. Clerc observed an abnormal scalenus medius muscle in his patient. The following year Henry and Handousa recorded the case of a young patient who suffered "gargling of the fingers" of the left hand while sleeping on the left side. The pulse was absent in the arm but returned 30 seconds after the arm was elevated. No cervical rib was present.

In 1927, Adson and Coffey pointed out that since the scalenus anticus muscle played an essential rôle in the compression of the brachial plexus and subclavian artery against the cervical rib, simple section of this muscle should effect a cure. To prove this they reported on a series of patients who had been so treated with results as satisfactory as those formerly obtained by the more extensive operation of removing the rib. In a second article Brickner added 6 cases and stressed the fact that in the operative treatment the anterior scalenus muscle should be sectioned in order to remove all pressure from the brachial plexus. Stiles in 1929 advised section of the lower end of the scalenus medius muscle and the anterior portion of the first rib. Puusepp reporting a case in 1931 considered the point of compression of the brachial plexus to be in the 'costo-inter-scalene trigone' formed by the first rib, and

scalenus anterior and scalenus medius muscles. His patient had an ipsilateral Horner's syndrome. For treatment, he advised section of the anterior scalenus muscle. In 1935, Ochsner reported 6 cases of scalenus syndrome of the type in which we have been especially interested. The following year, Wartenberg covered most of the German literature bearing on the subject. He included the scalenus syndrome in the large group of factors responsible for "brachialgia statica paraesthetica" and quoted Gaupp who, in 1894, said that there might be some angulation of the brachial plexus between the clavicle and the first rib. Braus suggested, in 1921, the possibility of compression between these two structures. In 1936 also, Flothow recorded 2 cases in which cervical ribs were present and 2 in which they were not, although all the patients had the same symptoms. In the 2 without cervical rib, section of the anterior scalenus muscle resulted in complete relief. In 1937, Craig and Knepper reviewed 6 cases of the scalenus syndrome and, in the same year, Henschen and Heusser reported 2 cases and discussed the operative treatment.

In the literature to date are the reports of 51 patients who had symptoms of cervical rib, but in whom this anomaly was not found.

Many persons with cervical ribs are free from symptoms until some time in adult life, and many carry these anomalies throughout life without symptoms. These accessory ribs vary greatly in size and in length. When they spring from the seventh cervical vertebra and are of sufficient length—5 centimeters or more—they pass forward beneath the lower cord of the brachial plexus and the subclavian artery. When ribs of this size are present, it has been our experience that simple section of the scalenus anticus will not suffice to relieve all of these patients of their symptoms, but that resection of the rib is also necessary. It has become apparent that, in the patients with symptoms from large cervical ribs and in those included as presenting the scalenus syndrome, similar factors may be concerned in the appearance of symptoms. All of them contribute to the mechanism that eventually causes undue pressure on the brachial plexus. Among them are points of embryological,

anatomical, developmental, and occupational interest.

In the embryo, the arm-bud appears with its axis of growth at the level of the seventh cervical segment, but several segments are included. In time, the longitudinal growth exceeds the transverse growth of the bud, so that the nerves which pass into it tend to converge from above and below. It has long been known that some variation in the position of the limb-buds relative to the body segments occurs. A prefixed plexus is one with a more cephalic innervation, while a postfixed plexus has a larger contribution from lower roots such as the second thoracic. The variation in the position of the developing limb-buds thus determines the variation in the nerves which supply them, the prefixed plexus having a larger contribution from the fourth cervical segment. The lowest trunk of the brachial plexus is composed of the eighth cervical and first and second thoracic roots. With a postfixed plexus, these large contributions to the brachial plexus pass more obliquely upward to cross the first rib, or the cervical rib if such is present, before they turn downward to pass into the arm. It is much easier, because of their course, for them to be subjected to angulation, tension, and stretching. In the embryo, the elements of the nervous system are larger than the mesoblastic masses which later develop into ribs, and the neural elements affect the growth and form of these. The grooves which appear in bones and correspond with the course of nerves bear evidence of such a sequence of development. These are seen on the upper surface of the first rib and in the upper arm in the groove for the musculospiral nerve.

Anatomically, the lower roots of the brachial plexus and the subclavian artery arch upward and over the upper portion of the rib cage where they may be angulated abruptly. In addition to this angulation, these structures pass slightly forward, so that the scalenus anticus restrains them and holds them in a more dorsal position than they otherwise would assume. The anatomical relationships vary not only in different persons, but in the same person, depending upon posture and other factors, among which are the relation-

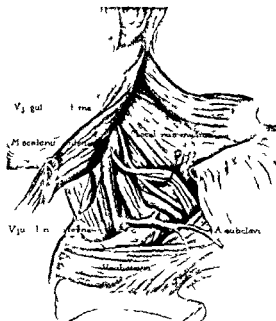


Fig. 1. Dissection of the left side of the neck to show the arrangement of the brachial plexus and subclavian artery as they curve over the first rib and behind the insertion of the anterior scalenus muscle.

ships of the position of the shoulder girdle to that of the thoracic cage.

Developmentally, in infants and children the relative position of the shoulder is high, but later, at puberty a gradual descent occurs to the adult position. In the female the descent is greater and the ultimate position of the shoulder is more sloping. This suggests a relationship between position and the greater incidence of the symptoms of cervical rib in women, and offers an explanation for the rarity of symptoms before adolescence.

The continued carrying of weights on the shoulder as in hod carriers and soldiers may be the immediate and exciting cause of symptoms. Loss of muscular tone and the drooping of the shoulders as seen in the aged, are other possibilities. The relative positions of the shoulder girdle and the rib cage are important, as indicated by the fact that deep inspiration and raising of the rib cage may cause an alteration in the pulse on the affected side, together with a change in blood pressure. Such an inequality between the two sides

disappears when the arms are elevated. Many patients who have symptoms suggestive of tension on the brachial plexus have found that resting the elbow on the arm of a chair and leaning toward it so that the arm is supported, or resting the arm on a nearby table or supporting it in a sling, or lifting the extremity by placing the other hand under the elbow, gives relief.

In this study, the records of 18 patients were reviewed. Twelve had no evidence of cervical rib, in 6 very small ribs were present, but were not seen at operation.

CASE REPORTS

CASE 1. Mrs. M. C., 40 years of age, entered the hospital on June 4, 1929, complaining of aching pain in the right shoulder and arm of 5 years' duration. This pain spread over the outer surface of the upper part of the arm and the inner surface of the forearm to the right fourth and fifth fingers. One year before her admission to the hospital the pain gave place to a feeling of numbness and occasionally of prickling in the same area. The pain had always been worse when the patient lay on the right side or on exposure to cold which caused the right hand to cramp in a claw position. For 2 years she had noticed a gradual wasting of the thenar eminence, more rapidly progressive during the year prior to admission. With this there had been great weakness of the thumb and first two fingers without sensory disturbance. More recently, she had observed weakness and wasting of the right forearm.

Examination corroborated the patient's observations. In addition there was a small area of diminished sensation to all forms of stimulation over the thenar eminence medially. The sensory loss was greatest in the area supplied by the right ulnar nerve. There was pronounced weakness of the muscles supplied by this nerve, less evident weakness of those supplied by the median nerve and no apparent weakness in the muscles supplied by the radial nerve. The right arm was colder than the left. The blood pressure on the right was 105/80 and on the left 120/80. The head was held deviated to the left. In the right supraclavicular fossa a firm pressure over the insertion of the scalenus anticus muscle caused considerable local pain and reproduced the tingling in the arm. Forcible turning of the head to the same side hyperextended of the neck or depression of the right shoulder caused an exacerbation of her symptoms. It did not, however, produce a fall in the right radial blood pressure.

On June 5, 1929, the right scalenus anticus muscle was exposed. It was under tension and exerted great pressure on the underlying subclavian artery which was forced back against the right brachial plexus. On dividing the muscle close to its insertion on the first rib the subclavian artery bulged forward

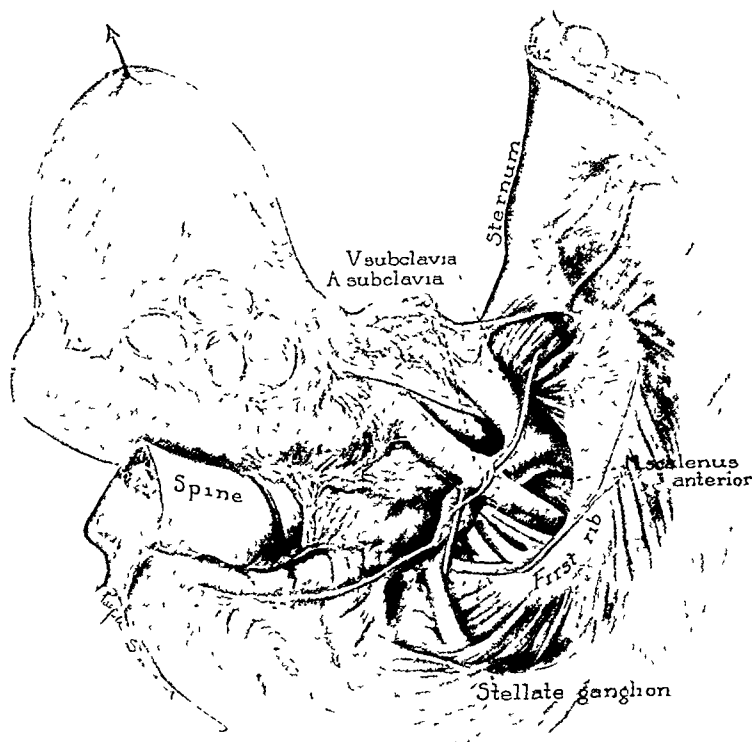


Fig 2 Dissection of the structures at the apex of the thoracic cage, viewed from inside. The neurovascular structures may be seen in close relation to the first rib with the subclavian artery separating the brachial plexus from the anterior scalenus muscle

and the brachial plexus behind it was no longer tense. Three days after operation the right arm was much stronger and, objectively, felt as warm as the other. The blood pressure was then 110/80 in the right arm and 112/80 in the left. The pain was entirely relieved and the patient was discharged from the hospital on the fifth day. Two months later, she had no complaints and both the right forearm and the right thenar eminence had begun to increase in size.

Many of the patients had similar histories, but a few presented other interesting symptoms and signs.

CASE 2 Mrs. L. P., 42 years of age, had suffered for a year and a half from a feeling of pressure on the outer side of the right shoulder, with numbness in the right fourth and fifth fingers. There was flushing of the skin of both arms as well as a peculiar tenseness of the skin on the right hand. X-ray examination of the cervical spine showed enlargement of the transverse processes of the seventh cervical vertebra, more evident on the right side. By measuring on the film, the transverse process of the seventh cervical vertebra was shown to be 1.1 centimeters longer than

that of the first thoracic vertebra. At operation, the chief abnormality found was undue tension on the right subclavian artery. All complaints were relieved by myotomy of the right anterior scalenus muscle.

CASE 3 Miss I. B., 21 years of age, had noticed a severe dragging pain over the right scapula for 7 years which so interfered with movement of the right arm that she could not carry even a small bag without increasing the pain. Numbness and tingling were present over the ulnar side of the right hand and arm, with some weakness in the right hand. For relief, she held her head turned to the left and tilted to the right. With the patient at rest, the blood pressure in the two arms was equal, but with tension on the right scalenus anticus muscle, the right radial pulse disappeared and the blood pressure in the right arm fell to zero. In x-ray films of the cervical spine, the transverse process of the seventh cervical vertebra was only 1 millimeter shorter than that of the first thoracic vertebra, and the transverse process on the right was much larger than that on the left. At operation there was extreme pressure on both the right subclavian artery and the right brachial plexus. Eight days after myotomy of the

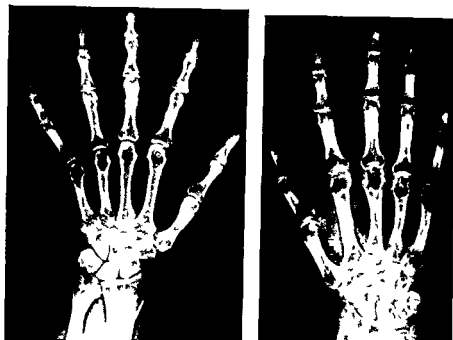


Fig 3 Case 6 G S Roentgenograms of both hands of patient demonstrating the advanced osteoporosis of the right phalanges carpus and even the bones of the forearm

right anterior scalenus muscle the patient was free from symptoms

CASE 4 Mrs T E 31 years of age had had sharp pain in the right hand for 6 years. The pain was worse at night. Three months after the onset pain was felt in the left hand as well and the patient soon noticed a constant tingling over the ulnar distribution on both side. On 7 occasions she had experienced attacks of numbness over the entire right side of the face arm and hand lasting for 1 hour each time and precipitated once by reaching down to pick up her baby. By auscultation above the clavicle on either side a bruit could be heard when the anterior scalenus muscle was tensed. On exposure of the right scalenus anticus muscle it was found to have an attachment to the first rib over a distance of 5 centimeters. Myotomy was done. Within a few hours the patient was free from pain even when the right shoulder was strongly depressed.

CASE 5 R F a busy surgeon 49 years of age suspected that he had syringomyelia because he had suffered from aching over both trapezi for 12 years. This spread to the right side of the neck and the upper part of the right arm 8 months before admission. Numbness and tingling corresponding to the distribution of the median and ulnar nerves had been present in the right forearm and hand for 6 months when he was first seen. Even the wearing

of rubber gloves made the pain worse. He was also subject to hemicrania on the right with visual phenomena pointing to the right hemisphere. After myotomy of the right scalenus anticus muscle there was gradual but steady improvement so that in 3 weeks he felt greatly improved. In 4 months he was almost back to normal and within a year he was completely cured.

CASE 6 Mrs C S 54 years of age had felt a dull aching in both shoulders for 6 years and a severe crushing pain in the right finger tips for 6 months. Finally she could move about only by carrying the right arm supported in a sling. The right pupil was larger than the left but there was no other sign of Horner's syndrome. The blood pressure was the same in both arms. The tips of the right second third and fourth fingers were tender to firm pressure as were the bases of all the metacarpals. The joints were swollen and tender. The bone showed marked osteoporosis and a diagnosis of atrophic arthritis had been made. On examination the characteristic radiation of pain with some sensory change over the ulnar area and tenderness of the scalenus anticus muscle led to a myotomy of this muscle. Five days later the pain had entirely disappeared and one and one half years following operation the only symptom that could be found in this patient was an occasional numbness of the tip of the right fifth finger.

CASE 7 Mrs L L, 52 years of age, had had severe, sharp pain over the precordium for a year and a half, and a diagnosis of angina pectoris had been made. Severe organic heart disease had followed a fever in early life. The pain was brought on by exercise only if the left arm participated, and it prevented her from raising the left hand to her head. There was also numbness in the left fifth finger. Although the pupils were equal, she had a narrower lid-slit on the left. The left radial pulse was weaker than the right, the blood pressure was 117/80 on the right and 110/70 on the left. She had been totally disabled by the severity of the pain for a year and a half, but 2 days after myotomy of the left scalenus anticus muscle, the pain was very much less. After 2 weeks it disappeared entirely and shortly thereafter she was able to resume her work as a physical therapist.

An analysis of the 18 cases studied disclosed the following findings. Among the 12 patients without cervical ribs the condition was twice as common in women as in men. The age of onset varied from 14 to 60 years, with an average age of 32 years, although the majority of patients were between the ages of 20 and 30. The duration of symptoms had been from 5 months to 15 years, with an average of 5 years. One patient was affected bilaterally. Of the others, 8 had symptoms on the right side and 3 on the left. A history of injury was obtained in 5 of the 12 cases.

Among the patients with rudimentary cervical ribs there were 5 females and 1 male. They were in a later age group, the average age of the onset of symptoms being 45 years. The duration of symptoms had been slightly longer than among those in the group mentioned above. The condition was bilateral in 1 patient, on the right side in 2, and on the left in 3. None gave a history of trauma. One cannot fail to be impressed by the wide variety of symptoms presented by these patients. One of the most common complaints is that of a heavy dragging sensation in one or both shoulders, or pain over the deltoid area, which at times extends down the arm often centering in and about the elbow. In more severe states, the pain extends down the forearm into the hand on the ulnar side, occasionally it may appear on the radial side. Certain forms of exercise of the extremity exaggerate the pain, and tenderness over the lower third of the scalenus anticus muscle immediately above the clavicle is unfailingly

greater than normal. Other symptoms and signs are more variable. At times the pain is indicated as radiating up in the region of the trapezial fold or up into the cervical region or head. The patient may indicate discomfort over the region of the seventh cervical vertebra, which is sometimes relieved by extending the head and neck. In some, use of the extremity is prohibited by the production of pain, and the arm is carried in a sling. Others make the statement that certain acts, such as playing the piano or sweeping, are particularly likely to cause an increase in symptoms. A subjective feeling of numbness or sensory alteration over the ulnar area or even over the radial part of the hand is much more common than objective impairment of sensation. The latter, however, though mild, is not infrequent and is usually over the area of the ulnar nerve. Rarely has the condition gone on to more than a slight atrophy of the intrinsic muscles of the hand. In the scalenus syndrome, as in the majority of cases of cervical rib, marked circulatory alterations in the extremity are not frequent. In 1 patient without a cervical rib, however, the pressure on the subclavian artery was sufficient to occlude it. Gangrene of the terminal portion of the extremity resulted, and amputation was required. Milder evidences are not uncommon—for example, a blood pressure lower by 10 or 15 points on the affected side, an alteration in oscillometric reading, or perhaps some slight vasomotor change. In the English literature, Stopford called attention to the position of the sympathetic fibers which lie on the undersurface of the inner cord of the brachial plexus so that they are readily subjected to pressure. It is his belief that the circulatory changes in the extremity are brought about through the agency of mechanical pressure upon these sympathetic fibers. In our experience, however, it has been unusual to find marked circulatory alterations, though a larger series of these cases of scalenus syndrome might well reveal other striking instances of them.

Motor symptoms were usually late in appearing and, in many patients, an apparent loss of power was actually caused by the pain incident to strenuous effort. True weakness

occurred in the small muscles of the hand in 7 cases, with thenar wasting in 2. Weakness of the flexors of the wrist was found in 3 patients.

Without exception, the pain was brought on or increased by tensing the anterior scalenus muscle on the affected side. This was most commonly discovered on carrying objects with the arm extended, but could usually be elicited by passive depression of the shoulder, turning the head forcibly toward the affected side, or, in many cases, by any muscular effort of the arm. Conversely, in every instance, elevating the shoulder by supporting the elbow alleviated the pain immediately.

Examination of the neck consistently revealed tenderness over the insertion of the scalenus anticus muscle on the first rib. A drooping shoulder was seen in only 2 patients. In 4, the head was held tilted toward the affected side or slightly turned to the opposite side, in such a position as to relax the scalenus anticus. On auscultation above the clavicle, an arterial bruit was heard in 2 patients, while in 8 the radial pulse was diminished in volume by tensing the scalenus anticus muscle on the affected side. At rest the blood pressure on the affected side was lower in 5 instances and higher in 3.

Evidence of sympathetic disturbance was present in 9 of the 18 patients. It consisted in flushing of the skin over the arm or hand, swelling of the hand, tenseness of the skin, cyanosis, brittle nails, rarefaction of bones, exophthalmos, migraine, and attacks of flushing over the blush area on the affected side. In 4 others the hand or arm was colder than its fellow, but this was assumed to be a direct effect of interference with the blood flow in the subclavian artery.

Among the patients seen have been many in whom the clinical picture seemed sufficiently typical to warrant a diagnosis of the scalenus syndrome and yet the symptoms were comparatively mild, causing hesitation in advising operation. In a considerable number of these improvement in the posture exercises to strengthen the trapezius and the muscles elevating the shoulder girdle have been followed by improvement and often by complete relief. It is our feeling that there must

be a considerable number of persons in this less severe group, in whom properly directed exercises will be sufficient to effect a cure.

It is assumed that the scalenus syndrome occurs in persons who have an inherent variation in their development. Three of our patients had other abnormalities. One of them with a bilateral scalenus syndrome, had more severe symptoms on the right side. She had, as well, a horseshoe kidney on that side, which required operation, and also a nodule in the right side of the thyroid. Another patient with the scalenus syndrome on the right had right hemicrania with symptoms referable to the left side of the body. The third had a flexed right fifth finger that was familial. Her scalenus syndrome was on the same side.

A history of trauma was obtained in 5 of the patients, none of whom had a cervical rib. It usually occurred shortly before the onset of symptoms and consisted in a blow from above on the affected shoulder so that it was forcibly depressed.

At operation there was in every case a definite tension on the subclavian artery and brachial plexus which were angulated against the scalenus anticus. This muscle was always firm tense and often appeared to be hypertrophied. On dividing it, the underlying structures were displaced forward and the brachial plexus was then seen to be lax. Some times the outer edge of the muscle sheath was thickened its free outer edge constituting the point of greatest pressure on the subclavian artery. In none of the patients reviewed here was a cervical rib seen at operation although when present, it could usually be felt on deep palpation.

Relief from pain usually dated from the day of operation, and sometimes began immediately on recovery from the anesthetic. In some patients it was complete within a week after operation, in others it came about gradually over a period of from 1 month to a year. The hypesthesia cleared rapidly, often in a few hours. Among the motor signs the generalized weakness of the extremity disappeared in a few days indicating that it was secondary to the pain. Atrophied muscles began to increase in size in about 2 months. Recovery though steady was sometimes pro-

longed, necessitating a convalescence of as long as 8 months, but resulting in a return to work such as had been impossible before operation

In half of the patients without cervical ribs, x-ray films of the cervical spine showed an enlargement of the transverse process of the seventh cervical vertebra so that it exceeded in length that of the first thoracic vertebra. This was possibly the result of overdevelopment of the costal element in the lateral mass of the seventh cervical vertebra. The transverse process of the seventh cervical vertebra was considered to be abnormally large if its tip extended beyond the limits of the first thoracic transverse process

The present study of 18 cases emphasizes certain aspects of the scalenus syndrome. The bizarre symptoms and insidious onset render early diagnosis difficult, as does the fact that objective signs may appear relatively late. The early symptoms are usually vague pains about the shoulder. Their one common characteristic is that they bear a definite relation to exercise and to posture. Trauma to the shoulder may have preceded the onset of symptoms. The patient with precordial pain, first diagnosed as having angina pectoris, illustrates how one may be misled in the interpretation of a single symptom.

Realizing the congenital structural peculiarities and the other factors more immediately responsible for the onset of the syndrome, we believe that the production of symptoms depends upon an abnormal relationship of the shoulder girdle to the thoracic cage and its attached structures. This conception is the guide to treatment whether by exercises and correction of posture or by operation.

SUMMARY

The diagnosis of the scalenus syndrome is made in patients who have symptoms and signs suggestive of cervical rib, but in whom roentgenograms show either no cervical rib or at most a small outgrowth that could not itself be responsible for the disability.

The condition has been observed for some time and reported under various headings, most of which point to an abnormality of the first rib as the primary cause. In many

respects the mechanism involved resembles that in patients with well developed cervical ribs.

The etiology consists largely in anatomical and developmental factors that result in an abnormal position of the shoulder girdle in relation to the thoracic cage. Embryologically, a postfixed brachial plexus is more readily subjected to tension and angulation in its course over the first rib and behind the anterior scalenus muscle. Injury, excessive occupational strain, or poor musculature may cause the shoulder to droop and precipitate the signs and symptoms.

The chief complaint of pain may be varied in character and distribution over the upper half of the body. The signs all point to a peripheral neuritis of the brachial plexus with striking relation to posture.

Myotomy of the scalenus muscle is required when postural exercises fail to relieve the symptoms. Operative results are excellent, though sometimes complete recovery takes several months.

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FURTHER STUDIES IN INFERTILITY AND STERILITY

An Analysis of 200 Couples

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SIX years ago we published the results of an analytic study of 300 couples (13) who sought advice because of their inability to conceive. Since that time, we have examined and treated an additional 200 couples for childlessness, the study and analysis of which is the basis of the present report.

The term, sterility, is used in this study to imply the *inability* to conceive, and by infertility, we mean any deviation from the normal level of fertilizability in the absence of a demonstrable cause for sterility. Infertility is a relative condition due to factors in one or both mates which, though often of a minor nature in themselves, in the aggregate constitute a definite barrier to conception. Thus, in dividing patients into the two groups, the matings wherein one or more accepted causes of sterility were demonstrated in either or both partners were classed as sterile. When none of the demonstrable causes for sterility was found, the mating was classed as infertile. In the latter group were included many apparently healthy childless couples in whom constitutional, endocrine, or other obscure factors played a part.

It is not within the scope of this paper to review all the literature on sterility or to name all those who made valuable contributions to the subject. One cannot, however, consider the subject of sterility without calling to mind such outstanding names as Huehner, for introducing the postcoital examination of the semen; Cary and Rubin, for devising a means of testing tubal patency, and the latter for his continued and intensive studies relative to the test, Dickinson, for his great interest in the manifold problems involved in the entire subject, and particularly

for his contribution on cervical cauterization; Meaker, for clinic organization and the scheme for orderly and complete investigation and for stressing the importance of considering the *mating* rather than the male and female partners as individuals, and Ogino and Knaus, for their clinical and Hartman, for his biological studies of ovulation and the sterility-fertility relationship. In addition, Burr, Hill, and Allen, and Rubinstein have recently demonstrated methods of identifying ovulation time, and Davis and Koff were able by means of a hormone derived from pregnant mares' serum to stimulate artificially ovulation in the human. That many worthy contributions have been omitted from this brief introduction is obvious. I do not desire to repeat or even to summarize the mass of accumulated material in the literature on the subject of sterility, but shall attempt to emphasize certain points which I believe to be significant in considering the sterility problem from a practical standpoint.

The plan of investigation herein outlined (Chart 1) is generally followed by us. When interviewing the patients for factual data, in addition to the usual gynecological history, the physician should attempt to obtain a correct picture of the menstrual and sex life of the female partner and the sex habits of the couple. When the woman relates that menstruation is regular and normal, one should ask to see a record of her cycles. Very few women keep accurate records, and the physician will do a creditable service by educating his women patients in the advisability and value of collecting such data. It would be well if girls at puberty were instructed to begin records of their periods and keep them throughout their entire menstrual lives. I have been distributing calendar cards to my patients for the past few years and have urged their continuous use. By collecting the calendars each year, we are learning that the regu-

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Dr. Max Ballin Memorial Lecture, Detroit, Michigan, March 16, 1938.

First of all, the vaginal secretion, which is normally acid, is inimical to long survival of the spermatozooids, perhaps that accounts for the great excess of male gametes (100,000,000 in an average ejaculate). However, it is not uncommon to find, in addition to dead sperms, innumerable actively motile forms in the vaginal pool from 1 to 2 hours after coitus. The next barrier to be met with is the cervical secretion. While normally this is clear, thin mucus with an alkaline reaction, one often finds it pathologically altered. A thick, tenacious mucous secretion is considered an even more effective barrier to sperm migration than a frankly purulent one. Under the microscope, it is common to observe the difficulties that spermatozoa have in migrating through tenacious mucus and somewhat surprising to observe their rapidity of motion in a mucopurulent sample. Both conditions are pathologic, however, and call for suitable management, whether or not they are associated with cervical erosions, polyps, strictures, or other endocervical disease.

I usually arrange to carry out the Huehner test at my office and have encountered no difficulty, the patient having been properly instructed to have coitus at home an hour previous to the appointment and to avoid unnecessary loss of semen before arrival. An ample pool of liquid secretion is generally found in the receptaculum (without the additional aid of intravaginal containers), which I find fully adequate for microscopic examination. A wire loop or pipette is used for transferring the vaginal specimen to a slide. The cervical samples are obtained by means of a glass aspirating pipette and bulb, and these samples are considered by us to be of utmost importance in judging the quality of the male contribution. Whenever a large number of actively motile, normal-appearing spermatozooids are observed in the cervical mucus sample, I regard the test as a satisfactory one. When, however, a scant pool, few or no sperms in the vagina, and feeble or immotile sperms only are found in the aspirated cervical mucus, a condom specimen is requested and a urologic examination is advised. It often happens that the husband is unwilling to co-operate beyond sending a

condom specimen and even in cases in which the semen is found to be substandard or completely deficient, the husband often refuses examination, thus leaving the investigation incomplete.

A general physical examination should be made of both partners. The genital status should be noted and evidence of developmental anomalies and of inflammatory disease particularly sought. On gynecological examination, the real infantile uterus is truly a rarity, but various grades of hypoplasia are commonly encountered. Whether called juvenile or prepubertal, the hypoplastic uterus is usually an indicator of endocrine deficiency resulting in genital underdevelopment. The ovarian deficiency or immaturity which accompanies hypoplasia is indeed significant and may be directly responsible for the uterine condition. Measurement of the uterine index (Meaker) may serve as a gauge of the functional capacity of the uterus. Other genital tract anomalies, such as those resulting from errors of fusion, may escape detection upon pelvic examination, to be discovered later in the investigation by means of x-ray examination. Various forms of septate, arcuate, bicornuate (Fig. 2) and the so called double uterus may be found, associated with or without a septate or double vagina. In the latter instance, a thick septum may require division in order that coitus be made possible. I have encountered 2 instances of failure of intromission for 1 and 5 years, respectively, because of septate or double vagina. It is worthy of note, however, that the ovarian development is usually not impaired in these various types of fusion defects and consequently conception occurs more readily than in hypoplasia.

Uterine displacements, flexions, and versions do not play so important a rôle in the etiology of sterility as was formerly believed. Acute ante flexion is usually associated with hypoplasia and indicates that ovarian rather than uterine function is primarily at fault. Retroversion in itself is not, as a rule, a serious barrier to conception since many patients are observed to have uterine retroversion but experience little difficulty in becoming pregnant.

Plan of Investigation

- I Male and female history
- II Physical examination
 - Male
 - A General
 - B Urological
 - C Condom or ejaculate
 - Female
 - A General
 - B Local gynecological
 - 1 Vagina and vulva
 - 2 Cervix
 - a Secretion
 - b Inflammation or polyp
 - 3 Uterus and adnexa
 - C Laboratory
 - 1 Complete blood Wassermann and Kahn, urine blood pressure
 - 2 Cervical smears
 - 3 Endometrial biopsy
- III Female
 - Postcoital examination (Huehner test)
 - A Microscopic examination of vaginal pool (1 to 2½ hours after coitus)
 - B Microscopic examination aspirated cervical mucus
 - IV Female
 - Tubal patency (Rubin test)
 - A Carbon dioxide gas
 - B Pneumoperitoneum
 - C Uterotubography (separately or combined)
 - V Male and female
 - Endocrine

Chart 1

lar menstrual cycle is a rarity and that its regularity is the rule. It is quite obvious that no intelligent consideration of the relatively sterile and fertile phases of the cycle is possible without accurate data and that the usual history taking technique is unreliable for this purpose.

A history of sex habits usually relates to the frequency of coitus and the occurrence of libido, orgasm, and variations of sex desire in the cycle, but it is important, from the standpoint of sterility, to inquire particularly whether coitus occurs in the estimated fertile phase of the cycle. I have observed instances in which failure to conceive apparently was due to coitus restricted to the pre- and post-menstrual phases of the cycle. A change in sex habit in this regard, and following the "rhythm" in reverse resulted in conception. Many patients still believe that fertility

reaches its maximum around the menstrual period.

Inquiry into the previous use of contraceptives should be made, particularly as to whether a vaginal method or an intra-uterine device was employed, and how long a period has elapsed since the patient ceased to use any contraceptive. Also, it is important to ascertain whether lubricants were being used to facilitate coitus inasmuch as most of the lubricants in general use possess contraceptive qualities. On the other hand, if contraception was apparently successfully employed with a method known to be of little merit, it would indicate the probability of sterility antedating its use.

Many patients will deny a history of venereal disease and indeed they may be unaware that they ever had such infection, yet on inspection the astute observer discovers such stigmas as inflamed Bartholin's or Skene's ducts, or a mucopurulent cervical discharge, such findings definitely influence his opinion and put him on his guard concerning possible tubal damage or other sequelæ or infection, factors of importance in the sterility picture.

It is my conviction that many patients who present themselves for the diagnosis of sterility do not require a complete investigation for at times obvious pelvic pathology is discovered upon the first examination. This may be of such a nature as to establish definitely a diagnosis of an absolute sterility as in certain extreme grades of underdevelopment (Fig. 1), or conditions requiring radical surgical treatment. Furthermore the performance of the Huehner postcoital test may reveal an azospermia, which upon condom and urologic check up, indicates a male absolute sterility. In such instances except as a matter of interest and study further investigation of the female partner is unnecessary unless artificial insemination is contemplated.

The postcoital test in my opinion is one of the most important and sensible of our investigative procedures in sterility. By means of the test we not only observe whether the male is fertile but at the same time learn to appreciate the obstacles which are naturally existent to the ascent of the spermatozoa.

TABLE I—INVESTIGATION OF 200 COUPLES

			Cases
Primary			146
Secondary			54
Infertility (relative)			103
Sterility			97
Relative—Male	25	Female	69
Absolute—Male	11	Female	8
Total	36		77
Both	16		
Duration of involuntary barrenness			
—1 to 20 years, average, 3 3 years			

obtained in this manner possess a greater diagnostic value than those taken with trans-uterine contrast media alone. When both methods are used together, one is able to ascertain the maximum information concerning the structure, development, alteration, and relationship of the pelvic organs short of actual laparotomy.

The relation of endocrines to sterility is a chapter by itself. I feel that much has been accomplished in the past few years in the study of the hormones but likewise believe that many of our present views concerning their actions will be altered in the future. The most promising developments in relation to the sterility problem seem to me to be the identification of ovulation time, the establishment of facts regarding single or multiple ovulation in the cycle, further evidence of viability or fertilizability of ova, and accumulation of more clinical data upon the fertility-sterility relationships in the sex cycle.

Endometrial biopsy obtained by suction curette (4) or other suitable instruments may prove of value in determining whether or not ovulation occurs, when performed in the premenstrual phase of the cycle, it is presumed that no ovulation has occurred if the sections reveal only the proliferative non-secretory stage. The bleeding in such a case is anovulatory in type. Unless ovulation occurs, followed by corpus luteum formation, the secretory phase of the endometrial cycle is absent. Davis and Koff showed that follicle ripening can be stimulated artificially in the human by the injection of gonadogen (hormone from pregnant mares' serum) at any phase of the cycle and that frequently more than 1 ovum is thus produced. In half of their cases, ovulation occurred in 18 to 36

TABLE II—ETIOLOGY OF FEMALE STERILITY

Etiological factor	No of cases	Etiological factor	No of cases
No apparent	73	Previous abortion	9
Cervicitis, erosion	35	Bicornuate uterus	3
Hypoplasia	23	Hypomenorrhea	2
Tubal obstruction, complete	15	Polymenorrhea	1
Tubal obstruction, partial	5	Pelvic mass	2
Ovarian cyst	13	Cervical stenosis	2
Bilateral polycystic Ovary	12	Anemia	2
Obesity	12	Hypothyroidism	2
Retroversion	10	Hyperthyroidism	1
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Fibroids	7	Intact hymen	2
		Vaginismus	1
		Previous laparotomy	47

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The present study is based upon the analysis of 200 couples examined in private practice since our previous report. Infertility plays a greater rôle in the present incidence, as 103 matings are so classified as against 97 in the sterility grouping. In our former series, there were 57 infertile and 243 sterile couples. In both groups, primary infertility or sterility occurred about 3 times as frequently as did secondary. The incidence of male and female factors and proportion of absolute and relative sterility are shown in Table I.

In the list of etiological factors, uterine hypoplasia, tubal obstruction, previous abortion, and chronic endocervicitis continue to play a significant part (Table II). The male partner is shown to be directly responsible in slightly over one-third of the cases of sterility, and among the infertilities, substandard sperm specimens were not infrequently revealed. Huehner tests were carried out in 125 couples, and in cases of unsatisfactory results, condom and urological tests were routinely requested.

Gross pathological lesions of the intrapelvic viscera may be discovered upon examination, such as multiple fibroids, tumors, and cysts of the ovaries, and inflammatory lesions of the adnexa. The tumors may require removal before proceeding with the sterility tests. Chronic inflammatory conditions are of particular interest in that they signify demonstrable damage to the fallopian tubes. Tubal obstruction as a result of the inflammatory disease, in which gonorrhea plays so significant a role, is one of the most tangible causes of female sterility. In the study of tubal obstruction, great strides have been made through the employment of the Rubin test and hysterosalpingography. The additional aid of pelvic pneumoperitoneum has proved in my hands (8) to be of material assistance in visualizing the extent of the damage and in recording the pelvic status (Fig. 3).

In cases in which the Huehner test has proved satisfactory and when no contra indication exists, tubal patency tests are routinely made in the office. Frequently, both tests are performed at the same visit, while motile spermatozooids are in the cervix and corpus uteri, in the belief that by this means the sperm migration through the oviducts may be facilitated. I have never observed any harm resulting from thus combining the Huehner and patency tests. For testing tubal permeability, the Rubin kymographic apparatus (5) is satisfactorily utilized in conjunction with the author's self retaining cannula set (10) obviating the necessity of holding or manipulating the instruments during the test. In this way, the examiner is free for simultaneous auscultation over the tubal areas and observance of the tracing on the kymographic drum. The procedure is familiar to all gynecologists and there is no need to enter into details at this time. When obstruction is apparent by recorded pressures up to 200 millimeters of mercury, repeated tests are indicated. Our second test is usually performed in a special room in the x-ray department at Michael Reese Hospital where appropriate apparatus is available for testing with carbon dioxide instillation of iodized oil for roentgenographic purposes, as well as a suitable table (11) for taking pneumograms

with the patient in the modified knee-chest position. This is the desired posture for obtaining satisfactory roentgenograms after the production of pneumoperitoneum. A repeat Rubin test with carbon dioxide is made, this time the patient having been prepared with a cleansing enema 2 hours previously, followed by a dose of morphine and scopalamine, to act as an antispasmodic analgesic. If no obstruction is met, 1 liter of gas is allowed to pass into the peritoneal cavity and x-ray films are taken. If, however, obstruction is again encountered, the gas is introduced by the transabdominal route, and lipiodol is instilled after the patient is in the knee chest posture. One film is usually made of the pneumoperitoneum alone and subsequent films with the combined pneumoperitoneum and uterosalpingography. Additional films are taken at intervals of a few minutes to many hours to determine whether the obstruction is due to mechanical closure or merely to spasm. Frequently, 18 or 24 hour films are required to demonstrate the presence or absence of intraperitoneal spill. Thus hysterosalpingography and pneumoperitoneum are used to complement or supplement the information obtained by means of the Rubin test, all of which is of extreme value in arriving at a correct diagnosis.

By means of the combined uterosalpingography and pelvic pneumoperitoneum, the pelvic status may be clearly visualized on the roentgen film. The iodized oil indicates the character of the uterine cavity and tubal lumens, site of tubal obstruction, or permeability, and the gas permits organ outlines and relationships to be clearly registered by means of the contrasting gaseous medium.

The development of these methods of roentgen visualization of the pelvic organs has indeed been a most useful diagnostic aid particularly in the study of sterility, but also in the diagnosis of obscure and disputed gynecological conditions in general. From an experience of many years I can heartily recommend their employment as a part of the sterility study. It has been repeatedly shown that pneumoperitoneum by the transuterine or transabdominal route is free from danger, and that the x-ray films of the pelvic organs

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TABLE III—STERILITY TESTS

Test	No
Huehner's postcoital	125
Rubin patency	111
Lipiodol	42
Pneumoperitoneum, alone or combined with lipiodol	41

TABLE IV—SURGICAL TREATMENT OF STERILITY GROUP (FEMALE)

	No of cases		No of cases
Cutery	26	Hysterectomy	2
Ovarian resection	14	Manchester plastic Suspension	1
Bilateral	0	Bladder advancement	1
Dilatation and curettage	8	Trachelorrhaphy	1
Myomectomy	4	Perineorrhaphy	1
Salpingostomy	1	Salpingo oophorectomy	4
Perineotomy	1	Lysis of adhesions	4
Hymenal incision	2		
Oophorectomy	2		

Tubal patency tests were done in 111 cases, hysterosalpingography in 42, and pelvic pneumoperitoneum by the transuterine or transabdominal route in 41 cases. Tubal obstruction was encountered in 20, of which 15 were complete and 5 partial. The incidence of this cause in the sterility group is approximately the same as in our first series (20 per cent). We have continued the practice of performing the Rubin test immediately following Huehner's test in suitable subjects as both expedient and practical, and have had no occasion to regret this practice. In fact, we feel that conditions for fertilization are favored by this sequence of procedures, carried out within a few days of the estimated time of ovulation.

Surgical measures were carried out in 73 patients (Table IV). Linear cervical cauterization was the most frequently employed measure and has continuously proved to be satisfactory. Occasionally a second treatment, using the Kimble or Hyam method was required. Salpingostomy was performed in only 1 case in this series (without benefit) and no tubal implantations were done. The most interesting and most hopeful group from a surgical standpoint is that of 9 cases of sterility due to bilateral polycystic ovaries. In 5 of these amenorrhea was a feature of the clinical picture. The diagnosis of significant ovarian swellings (Fig 4) in each case was established by x ray after pneumoperitoneum, and bilateral cortical wedge resection resulted in the prompt return of the menses,

TABLE V—PREGNANCY FOLLOWING INVESTIGATION AND TREATMENT

	No	Per cent
Infertile matings	103	
Pregnancies (1 tubal)	31	47
Sterile matings	97	
Pregnancies (1 tubal)	15	15.4
Matings	200	
Total pregnancies	66	33

general systemic improvement and restored fertility. We have previously described this condition and its treatment (9), and have operated upon 32 patients to date with gratifying results. Many of these operations were upon single girls, obviously not included in this series, whom we have had occasion to observe for several years. After marriage, they continued to have normal menstrual periods, and some of them have borne children. In none of the cases of wedge resection have we discovered recurrence of cystic ovaries.

From the large percentage of pregnancies (Table V) which occurred in the group here reported it is apparent that a considerable proportion of the matings were only relatively infertile and the minority were really sterile. There can be but little doubt that if given time, a certain proportion of apparently infertile women eventually succeed in becoming pregnant without investigation or treatment, as occurred in 9 of the patients in this series. On the other hand, among couples apparently healthy pregnancy is often delayed for an indefinite time even though no contraceptive is used, and an investigation is urgently requested by them. In others, pregnancy follows immediately after the Huehner and patency tests are performed and before any other treatment becomes indicated. This fact strengthens our belief that the patency test with gas or with opaque media has therapeutic as well as diagnostic value. Pregnancy occurred in 15.4 per cent of the sterile matings after treatment of one or both mates and in 49 per cent of the infertile matings. In 5 of the latter, repeated pregnancies occurred. This incidence of 33 per cent for the 200 couples is decidedly higher than in our previous series (19.3 per cent). It is our feeling that instruction in sex habits, timing

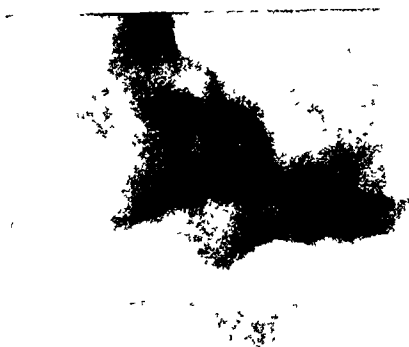


Fig 1 Transabdominal pneumoperitoneum Patient aged 21, primary amenorrhea Extreme genital hypoplasia (fetal type) A diagnosis of absolute sterility was made

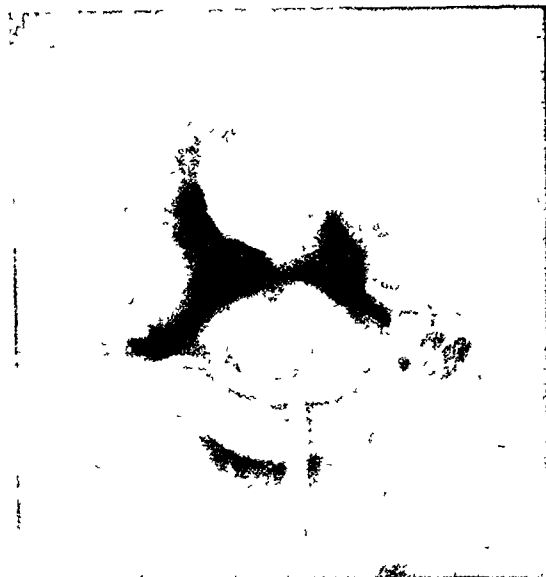


Fig 2 Transuterine pneumoperitoneum and hysterosalpingography Bicornuate uterus, patent tubes, right cystic ovary A diagnosis of relative infertility was made

of coitus in relation to the estimated fertile phase of the cycle, and general measures have been helpful (Table V) Glandular therapy played but a small part, its chief virtue resting in thyroid extract Estrogenic preparations were used in the treatment of hypoplasia and despite little change in the uterine size, pregnancy sometimes occurred One hesitates, however, to credit the results to the therapy employed in a small series Of many hormonal preparations tried from time to time, no striking results have been observed with any particular preparation The hormone now available from the serum of pregnant mares has been shown to stimulate ovulation in the human, and it is highly probable that this agent will prove of practical value in certain types of sterility Favorable results should be expected from such therapy in minor grades of hypoplasia associated with immature or inactive ovaries, and in cases of anovulatory bleeding When the ovaries have become polycystic, however, no result can be expected from hormone therapy Surgery is then indicated

CASE REPORTS

CASE 1 M W, aged 28 years, married 6 years, nulligravida Patient's menses were always irregular, occurring every 5 to 6 weeks The Huehner and patency tests proved satisfactory X-ray films taken after transuterine pneumoperitoneum revealed bi-

lateral polycystic ovaries A wedge cortical resection was performed on January 7, 1936 Menses immediately after became regular until May 25, 1936, when the patient became pregnant and delivered at term

Diagnosis Female sterility Operative treatment restored fertility

CASE 2 S S, aged 32 years Secondary sterility, 4 years Patient had had previous abortions The Huehner and patency tests proved satisfactory, amenorrhea followed tests A laparotomy was carried out 2 months later for a ruptured ectopic pregnancy

Diagnosis Infertility Tubal pregnancy followed patency test

CASE 3 H S, aged 29 years, married 8 years Patient's menses were irregular and profuse occurring every 28 to 32 days Curettage revealed a polypoid endometrium The Huehner and patency tests proved satisfactory X-ray films taken after pneumoperitoneum revealed a few small fibroids and a cystic left ovary At laparotomy, myomectomy, ovarian resection, and appendectomy were performed Patient became pregnant 8 months later

Diagnosis Female sterility. Operative treatment restored fertility

CASE 4 M S, aged 30 years, married 5½ years, nulligravida Patient's menses were regular Her uterus was hypoplastic Patient was given sistomycin for dysmenorrhea The Huehner and patency tests proved satisfactory Rhythm for fertility was advocated Second Huehner and patency tests were



Fig 3 Transuterine pneumoperitoneum and hysterosalpingography. Left adnexa previously removed surgically. Right tube patent to gas and fills with opaque media, right ovarian cyst. A diagnosis of secondary sterility was made.



Fig 4 Transuterine pneumoperitoneum. Patent tubes. Bilateral polycystic ovaries. A diagnosis of primary sterility was made.

followed immediately by pregnancy and patient delivered at term.

Diagnosis: Infertility. Fecundity restored after repeated patency tests.

CASE 5: S. W. aged 23 years, married 2½ years, nulligravida. This patient complained of sterility and failure of intromission. Her husband was operated upon twice for hypospadias. However, the operations were unsuccessful and resulted in a sharp ventral curve of the phallus on erection. The ejaculate specimen on examination proved satisfactory. Artificial insemination was carried out on five occasions at the time of estimated ovulation. A patency test was followed by pneumoperitoneum. The films revealed bilateral polycystic ovaries. A wedge cortical resection was done. Artificial inseminations were repeated after 6 regular menstrual periods without result. Intravaginal injection of sperm following attempted coitus was advised. The husband was referred to a urologist but refused further surgery.

Diagnosis: Male and female sterility. Surgical treatment of both partners. Failure.

CASE 6: C. L., obese orthodox Jewess, aged 31 years, married 2 years. Patient's menses were irregular, occurring every 21 to 26 days. Coitus was omitted during the first 2 weeks of the cycle. The Huehner and patency tests proved satisfactory. Thyroid medication and diet and change of ex-

habits were advocated. Patient lost 15 pounds in weight. The second Huehner and patency tests proved satisfactory for they were followed immediately by pregnancy and the patient delivered at term.

Diagnosis: Infertility. Fecundity restored by thyroid medication, diet, sex adjustment and repeated patency tests.

CASE 7: M. L. aged 27 years, married 7 years. Patient's menses were irregular. The Huehner test revealed necrospemia. The patency test proved satisfactory. The Huehner test was repeated after urological treatment and showed a few active spermatozoa. The patency test again proved satisfactory. Pregnancy immediately followed and the patient delivered at term.

Diagnosis: Male sterility. Fecundity restored after treatment of male.

CASE 8: A. L. aged 30 years, married 16 months, nulligravida. Male aspermia. X-ray films taken after pneumoperitoneum revealed a right dermoid cyst. At laparotomy, a right oophorectomy, left ovarian resection and appendectomy were performed. At a second laparotomy 5 years later, myomectomy was performed. Five years later at a third laparotomy, hysterectomy for multiple fibroid was carried out.

Diagnosis: Male and female absolute sterility.

CASE 9: A. C. aged 32 years, married 8 years. The Huehner test revealed necrospemia. Urological therapy was carried out but no improvement occurred.

Diagnosis: Male sterility.

CASE 10 E H, aged 30 years, married 5½ years The Huehner test revealed necropermia Urological examination revealed unsatisfactory sperm The Rubin test proved non-patency A tubal obstruction was present

Diagnosis Male and female absolute sterility

CASE 11 L F, aged 31 years, married 2 years Menses were irregular occurring every 1 to 5 months X-ray films taken following pneumoperitoneum revealed bilateral polycystic ovaries A wedge cortical resection was done The menses became regular and pregnancy occurred 1 year later A spontaneous 5 month miscarriage resulted

Diagnosis Female sterility Fertility restored following ovarian resection

SUMMARY AND CONCLUSIONS

1 In this analysis of 200 childless couples, infertility was more frequently encountered than sterility

2 The male partner was responsible for about one-third of reproductive failures

3 Roentgenographic methods (pneumoperitoneum and hysterosalpingography) were of material value in the investigation of the female partner

4 Pregnancy occurred in almost half of the matings in the infertility group and in only 15.4 per cent in the sterility group after investigation and treatment

5 Successful treatment in the infertility group was chiefly attributable to cervical cauterization, patency tests, and sex adjustments In the sterility group, hormone therapy in the male and surgical treatment in the female were at times successful

Note—I gratefully acknowledge the valuable assistance of my colleague, Dr M L Leventhal, and my associates, Dr M R Cohen and Paula Bennett, in preparing the material for this paper

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Fig. 3 Transuterine pneumoperitoneum and hysterosalpingography. Left adnexa previously removed surgically. Right tube patent to gas and fills with opaque media. Right ovarian cyst. A diagnosis of secondary sterility was made.

followed immediately by pregnancy and patient delivered at term.

Diagnosis: Infertility. **Fecundity:** restored after repeated patency tests.

CASE 5. S. W. aged 3 years married 2½ years nulligravida. This patient complained of sterility and failure of intromission. Her husband was operated upon twice for hypospadias. However the operations were unsuccessful and resulted in a sharp ventral curve of the phallus on erection. The ejaculate specimen on examination proved satisfactory. Artificial insemination was carried out on five occasions at the time of estimated ovulation. A patency test was followed by pneumoperitoneum. The films revealed bilateral polycystic ovaries. A wedge cortical resection was done. Artificial inseminations were repeated after 6 regular menstrual periods without result. Intravaginal injection of sperm following attempted coitus was advised. The husband was referred to a urologist but refused further surgery.

Diagnosis: Male and female sterility. **Surgical treatment:** of both partners. **Failure.**

CASE 6. C. I. obese orthodox Jewess aged 31 years married 2 years. Patient's menses were irregular occurring every 21 to 26 days. Coitus was omitted during the first 2 weeks of the cycle. The Huehner and patency tests proved satisfactory. Thyroid medication and diet and change of sex



Fig. 4 Transuterine pneumoperitoneum. Patent tubes. Bilateral polycystic ovaries. A diagnosis of primary sterility was made.

habits were advocated. Patient lost 15 pounds in weight. The second Huehner and patency tests proved satisfactory for they were followed immediately by pregnancy and the patient delivered at term.

Diagnosis: Infertility. **Fecundity:** restored by thyroid medication, diet, ex adjustment and repeated patency tests.

CASE 7. M. L. aged 27 years married 7 years. Patient's menses were irregular. The Huehner test revealed necropermia. The patency test proved satisfactory. The Huehner test was repeated after urological treatment and showed a few active spermatozoa. The patency test again proved satisfactory. Pregnancy immediately followed and the patient delivered at term.

Diagnosis: Male sterility. **Fecundity:** restored after treatment of male.

CASE 8. A. L. aged 20 years married 16 months nulligravida. Male aspermia. X-ray films taken after pneumoperitoneum revealed a right dermoid cyst. At laparotomy a right oophorectomy, left ovarian resection and appendectomy were performed. At a second laparotomy 5 years later myomectomy was performed. Five years later at a third laparotomy hysterectomy for multiple fibroid was carried out.

Diagnosis: Male and female absolute sterility. **CASE 9.** A. C. aged 32 years married 8 years. The Huehner test revealed necropermia. Urological therapy was carried out but no improvement occurred.

Diagnosis: Male sterility.

Carotid body The carotid body, also known as ganglion or paraganglion intercaroticum, glandula carotica, glomus caroticus, has been described in mammals, birds, and reptiles and was presumably identified in amphibia and fishes (Ask-Upmark). There are a number of hypotheses as to its origin. It was, for instance, assumed to be in the pharyngeal wall, sympathetic plexus, or in the adventitial tunics of the carotid vessels (Hammar). Hering thought with some reason that the carotid body belongs with the glands secreting a specific substance in the nature of adrenalin, the presence of which, however, could not be demonstrated by Aszodi and Paunz in the carotid body of rabbits.

Whatever the nature of the carotid body, it is definitely established that it is connected with the carotid sinus and receives branches from numerous nerves (glossopharyngeal, sympathetic, upper laryngeal, vagus, and hypoglossal). Some investigators (Ask-Upmark, Princeteau, Gerard and Billingsley, and others) speak of branches derived also from the intercarotid plexus which, as has been emphasized, is formed by the sympathetic, vagus, glossopharyngeal, and, partly, by the hypoglossal nerves.

F de Castro described a periglandular nervous plexus of the carotid body. Such a plexus is formed by single branches of the upper cervical sympathetic ganglion, intercarotid nerve *in toto*, a branch of the glossopharyngeal nerve, and the pharyngeal branches of the vagus nerve.

PERSONAL OBSERVATIONS

On the whole, the problem of the carotid body and its nerve supply has been studied mainly in its relationship to the heart and aorta and in a rather small number of specimens. The reason is that the ordinary methods of dissection of the delicate nerve twigs are time consuming and the nerve twigs are easily damaged, thus necessitating repeated dissection of certain parts of cadavers which must be fresh always. The largest number used for such studies was by Cordier and Coulouma (15 cadavers) while in my work I used 35. The dissection was done by the method of Worobiew and was not confined to

the neck but extended to the regions of the head innervated by the second and third branches of the trigeminal nerve. These additional dissections enabled me to investigate the connections of the trigeminal areas with the carotid sinus and to give a morphologic explanation for the painful syndromes of the temporal and parietal regions as described by Heymanovitch.

PERSONAL INVESTIGATIONS

I used only fresh cadavers which had not been preserved in special fluids, such as a solution of formaldehyde. The head was sawed sagittally into two equal parts in which two topographic regions (*regio colli* and *regio capitis*) were carefully mapped out. An incision of the skin was made along the lower border of the mandible and extended underneath the ear, through the mastoid, and down the lateral border of the trapezius muscle; a thread was passed through the incised border and by pulling it up it was possible to demonstrate the superficial muscles of the neck. By turning upward and downward the cut segments of the platysma and sternocleidomastoid muscles one could see the region of the carotid arteries. The specimen then was kept for 1 or 2 hours under a continuously flowing stream of water which made the cellular tissues friable and easy to dissect by Worobiew's method (under constantly falling drops of water). The falling of the drops caused further swelling of the tissues and made it possible to demonstrate macroscopically the minutest ramifications of nerves scarcely visible even when dissected with the finest anatomic pincers and special needles. It was thus possible to visualize (from the side of the skin) the topography of the carotid sinus nerve, its relation to the carotid artery, and some of its connections with nerves which could be studied at a given level. In order to make visible the origin of the carotid sinus nerve, we had to cut through the dorsal half of the digastric muscle, to shift laterally, to remove completely in some cases even the internal jugular vein, and to raise the border of the parotid gland. This also enabled me to study the cranial nerves at the place of their emergence from the jugular foramen. Removal

SURGICAL ANATOMY OF CAROTID SINUS NERVE AND INTERCAROTID GANGLION

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THE term carotid sinus (bulbus or sinus caroticus) is applied to a dilated portion of the internal carotid artery, which lies just above the division of the common carotid artery into its two main branches. This particular segment of the internal carotid artery which has been known for a long time is also present—though is less developed—in children, and may also be demonstrated in embryos and in animals of every species. In those animals in which the role in the cerebral circulation is dominated by the occipital artery, the dilated zone is located at the mouth of the latter and not on the internal carotid artery.

The walls of the carotid sinus possess characteristic histologic features—an onion like structure (15) and thinness which is due mainly to the reduced size of the media. The external tunic consists of a wide network of elastic fibers while the intima is hyperplastic. Ask Upmark (1935) emphasized the thickening of the adventitial tunic which is provided with a special system of receptors between the collagenous layers (especially well developed in the widest portion of the sinus). On the other hand Druener found no difference between the histologic features of the carotid sinus and those of the carotid artery as a whole.

The nerve supply of the carotid sinus is known under different names: ramus caroticus n. glossopharyngei (Brauecker), ramus descendens n. glossopharyngei (Druener) and sinus nerve (Knoll Hering). The sinus nerve and its anastomoses with the vagus nerve are pictured in the atlas of Spalteholz (Fig. 776) but is nowhere mentioned in the text.

Sinus nerve. While accepting Hering's term 'Sinusnerv,' one should bear in mind the

complex relations between this nerve and the intercarotid ganglion and that the nerves emanating from the carotid sinus do not terminate in its walls but continue their courses over the common carotid artery giving up terminal twigs to the thyroid, thymus and pericardium. For this reason Druener rejected Brauecker's designation 'ramus caroticus n. glossopharyngei' and suggested the name 'ramus descendens n. glossopharyngei'. F. de Castro enumerated a number of nerves that form the plexus surrounding the carotid ganglion and particularly emphasized a nerve called by him "nervus intercaroticus". According to Sunder Plassmann and others, this nerve does not remain isolated in its course but forms anastomoses with other nerves. Ask Upmark, Cordier and Coulouma stated that the different nerves connected with the carotid sinus form loops and thus give rise to complicated structures of which at least five can be differentiated. Hovelacque, Mars, Binet, and Gayet maintain that the carotid sinus branches usually arise (with two branches) from the main trunk of the glossopharyngeal nerve 1 centimeter below its emergence from the cranial cavity and that only rarely do they originate from the pharyngeal branches of the glossopharyngeal nerve. In their further course down the internal carotid artery the foregoing nerves form anastomoses with the branches from the vagus and sympathetic nerves thus participating in the formation of the carotid plexus.

Observations of Binet and Gayet, Brauecker, Darnelopolu and others justify the conclusion that the innervation of the carotid sinus is usually supplied by the glossopharyngeal nerve itself and less frequently by its pharyngeal branches. In its course the glossopharyngeal nerve forms anastomoses with the pharyngeal branches of the vagus superior cervical sympathetic ganglion and only occasionally with the superior laryngeal nerve.

From the laboratory of Experimental Neurosurgery of the Central Lychoneurological Institute (Prof. Z. J. Heymans), Head of Laboratory, translated by Prof. L. J. Nemtsher (Kharkov 1955) and edited by Dr. George B. Hassner (Chicago).



Fig 3 Illustration of the relationship between the superior cervical sympathetic ganglion, *cs g*, carotid body, *I*, and the carotid sinus nerve, *II*, *I*, Glossopharyngeal nerve, *II*, carotid sinus nerve, *III*, carotid body, *IV*, superior laryngeal nerve, *V*, a branch from the carotid body, *VI*, to the superior cervical sympathetic ganglion, *cs g*, *VII*, anastomosis between the carotid sinus nerve and the superior cervical sympathetic ganglion, *VIII*, vagus nerve, *XX*, internal carotid artery



Fig 4 This figure illustrates the anastomosis, *IV*, between the carotid body, *II*, and the superior cervical sympathetic ganglion, *V*, *I*, Glossopharyngeal nerve, *III*, vagus nerve

to the pterygopalatal fossa from the side of the skin of the face, it was necessary to open the pterygoid canal, after the outer wall of the orbit had been previously removed

As dissected specimens usually give poor photographs, hand drawings are sometimes preferable and one is supplemented in this paper for a photograph

ANATOMIC CONSIDERATIONS

Figure 1 shows the carotid sinus nerve, *II*. The nerve originates by two twigs from the stem of the glossopharyngeal nerve *I*, 1.5 centimeters below the point of its emergence from the cranial cavity. The two twigs merge to form a single nerve which descends along the internal carotid artery. At the middle of its course the nerve gives off a branch for the superior laryngeal nerve, *IV*, and a little

below two or three smaller branches for the internal carotid artery. In its lower part the nerve forms a wide network with terminal ramifications ending in the carotid sinus, *sc*. Here also terminate single twigs of the glossopharyngeal and vagus nerves (through its pharyngeal branch), both nerves receiving anastomoses from the carotid sinus nerve (*V* in Fig 2). At the place of bifurcation of the common carotid artery the carotid sinus nerve breaks up into small twigs which participate in the formation of the sinus carotid plexus. To demonstrate the connection between the carotid sinus nerve and the intercarotid ganglion (carotid body) and the upper cervical sympathetic ganglion it was necessary to cut the internal carotid artery and turn the segments upward and downward (*XX* in Fig 3). After the carotid sinus nerve has given off a branch (*VI* in Fig. 3) to the superior cervical sympathetic ganglion (*cs g*), it descends to the bulbus caroticus where it divides into two thin branches envel-



Fig 3 Illustration of the relationship between the superior cervical sympathetic ganglion, *c s g*, carotid body, *I*, and the carotid sinus nerve, *II*. *I*, Glossopharyngeal nerve, *II*, carotid sinus nerve, *III*, carotid body, *IV*, superior laryngeal nerve, *V*, a branch from the carotid body, *III*, to the superior cervical sympathetic ganglion, *c s g*, *VI*, anastomosis between the carotid sinus nerve and the superior cervical sympathetic ganglion, *VII*, vagus nerve, *XX*, internal carotid artery

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Fig. 1 Illustration of the course of the carotid sinus nerve from its origin (the glossopharyngeal nerve) I Glossopharyngeal nerve II carotid sinus nerve III pharyngeal branch of the vagus nerve IV superior laryngeal nerve V superior cervical sympathetic ganglion sc carotid sinus



Fig. 2 Connections between the carotid sinus nerve and the vagus nerve I Glossopharyngeal nerve II the pharyngeal branch of the vagus nerve III carotid sinus nerve IV accessory nerve V anastomosis between the carotid sinus nerve III and vagus nerve VI VI vagus nerve sc carotid sinus

of the anterior wall of the latter (with Luer's small tongs) served the same purpose very well. In cases in which we intended to determine more accurately the connections between the sympathetic vagus and superior laryngeal nerves, the dissection was begun from the median plane of the head. This made it possible to follow up the origin of the anastomoses between the carotid sinus nerve and the carotid body and in addition to demonstrate the terminal branches of the nerves which descend along the posterior wall of the common carotid artery.

To fulfill my second task—the demonstration of the anastomoses with the ganglia of the second and third branches of the trigeminal nerve—it was necessary to lay open the mastoid region, open up the tympanic antrum (as it is done in the radical operation of Stacke), facial canal and tympanic canal. This enabled me to trace the tympanic nerve

from its place of origin in the glossopharyngeal nerve and follow up its further course as superficial petrosal nerve to the otic ganglion. This is well illustrated in specimens in which the mandibular nerve has been dissected from the inner side and the internal pterygoid muscle has been turned down in the middle part of its upper border. In the same specimen one could study the superficial petrosal major nerve and its anastomosis with the tympanic nerve. In order to demonstrate its further course—under the name of vidian nerve—to the sphenopalatine ganglion as well as the ganglion itself, I prepared a series of specimens in which the foregoing structures may be seen both from the side of the skin of the face and the median (the sawed) plane of the head. For the latter purpose I removed a part of the body of the basal bone and opened the pterygopalatal fossa and the palatal canaliculi, while in order to get easier access

possible to detect that the carotid body is connected with the carotid sinus nerve, either directly or indirectly, through nerves with which it forms anastomoses (pharyngeal branch of the vagus nerve, a branch of the glossopharyngeal nerve, a large nerve bundle from the cervical sympathetic ganglion, the superior laryngeal nerve, and a branch from ramus descendens n hypoglossi) The most constant branches come from sympathetic, glossopharyngeal, and vagal nerve branches

Figure 5 demonstrates the anatomic connections of the carotid body with the ganglia of the second and third trigeminal branches. Clinical observations of the carotid-temporal-neuralgic syndrome made it necessary, as has been mentioned, to study in fresh cadavers with the method of Worobiew the corresponding areas of the temporal region, notably its vascular and nerve supplies. I could demonstrate the terminal divisions of the second trigeminal branch, the zygomaticotemporal rami. These nerves are constant and coincide anatomically with the distribution of the frontal branch of the superficial temporal artery (Fig 6). It was also possible to establish a relationship between the terminal branch of the external carotid and the auriculotemporal branch of third division of fifth nerve. Two branches of this nerve surround the blood vessel at joint end of mandible and, without giving off branches, run upward.

Our preparations thus enabled us to establish definitely that the terminal branches of zygomaticotemporal ramus belong only to the vascular territory supplied by the frontal branch of the terminal branch of the external carotid, and to prove a relationship of the carotid sinus to the ganglia of one of the cranial nerves.

I believe that these facts may shed some light on the rôle the carotid sinus and carotid body play in normal and pathological conditions.

CONCLUSIONS

1 The carotid sinus nerve arises, as a rule, from the trunk of the glossopharyngeal nerve.

2 This nerve is connected: (a) with the trunk of the vagus nerve; (b) with its pharyngeal branches; (c) with the upper cervical sympathetic ganglion; (d) with the carotid body; and, much more rarely, (e) with the superior laryngeal nerve and the branches of the glossopharyngeal nerve.

3 A small number of the branches enter from above the plexus enveloping the internal carotid artery, some end in the carotid body while others continue on their way down along the common carotid artery.

4 The carotid body is connected with the upper cervical sympathetic ganglion, with the glossopharyngeal nerves, and with the vagal nerves.

5 Jacobson's nerve, n tympanicus, connects the carotid sinus nerve with the sphenopalatine and otic ganglia.

6 The terminal branches of the zygomaticotemporal ramus (from second trigeminal division) belong to the territory supplied by the frontal branch of the terminal branch of the external carotid.

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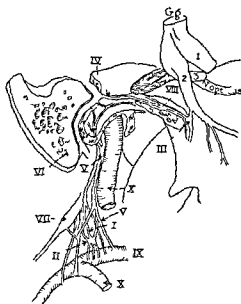


Fig. 5 The drawing illustrates the relationship between the carotid sinus nerve I carotid body II and sphenopalatine ganglion III IV Superior cervical sympathetic ganglion V glossopharyngeal nerve VI larger superficial petrosal nerve VII tympanic nerve VIII vidian canal IX external carotid artery X internal carotid artery XI gasserian ganglion with the three branches (1 2 3)

oping the carotid sinus in the wall of which they are buried. Another branch descends into the intercarotid ganglion at its medial border while at the opposite border one can see the branch connecting the superior cervical sympathetic ganglion with the intercarotid ganglion (Fig. 4).

In other specimens it was possible to demonstrate the connections between the carotid sinus nerve and the intercarotid ganglion (carotid body) with the vagus as well as with the sphenopalatine ganglion. The sphenopalatine ganglion in its turn is connected with the petrous ganglion of the ninth nerve and through the tympanic nerve or superficial petrosal nerve (minor) with the second branch of the trigeminal nerve. The superficial petrosal nerve (minor) is connected with the otic ganglion situated on the mesial surface of the third trigeminal nerve.

On the basis of our investigations we established the fact that the carotid sinus nerve arises, as a rule from the main trunk of the



Fig. 6 The terminal branch of the external carotid I with its branches frontal ramus II and parietal ramus III IV Terminal ramifications of the zygomaticotemporal nerve

glossopharyngeal nerve, usually with one sometimes with two, branches. In its course this nerve gives off numerous branches, especially from its lower half which join the main vagus trunk or its lower pharyngeal branches and also twigs from the upper cervical sympathetic ganglion. A small number participate in the formation of the plexus which surrounds and follows the internal carotid artery while another part ends in the carotid sinus. The branches descending on its dorsal surface belong to the superior laryngeal nerve. The carotid body (intercarotid ganglion) which as has been emphasized is situated at the bifurcation of the common carotid artery can always be found in the tissues of a fresh cadaver. For this purpose it is necessary to turn down the trunk of the common carotid artery and sometimes to push the main carotid branches sidewise and carefully to dissect the tissues under falling drops of water. The form of the carotid body varies: it is oval or may appear as a small ganglion with irregular borders, sometimes it is spider like provided with numerous nerve branches. Its size varies from a relatively large pinhead to that of a cherry pit. To render more visible the connections of the carotid body with different nerves it is necessary to shift the blood vessels. Then it is

possible to detect that the carotid body is connected with the carotid sinus nerve, either directly or indirectly, through nerves with which it forms anastomoses (pharyngeal branch of the vagus nerve, a branch of the glossopharyngeal nerve, a large nerve bundle from the cervical sympathetic ganglion, the superior laryngeal nerve, and a branch from ramus descendens n hypoglossi) The most constant branches come from sympathetic, glossopharyngeal, and vagal nerve branches

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RESISTANCE OF PERIPHERAL TISSUES TO ASPHYXIA AT VARIOUS TEMPERATURES

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LIGATIONS OF LIMBS

SEVERAL recent papers (1) have described the effects of the application of tourniquets to the legs of experimental animals. The local effects are reactive hyperemia and inflammation and paralysis and anesthesia of variable degree and duration, all governed by the length of time of the ligation. Excessively prolonged application of the tourniquet necessarily results in gangrene, from 2 causes, (a) lack of blood supply for a time longer than that for which the tissues can withstand asphyxia, (b) direct pressure effects in the zone of ligation, in the form of ulceration, necrosis, infection and thrombosis, followed by gangrene of the more distal parts. These secondary results of pressure commonly occur sooner than those from the lack of blood supply mentioned under (a) hence it is not always a simple matter to determine accurately the maximum duration of asphyxia which can be followed by complete and permanent recovery.

The constitutional effect of tourniquet application is a pure and typical form of secondary shock, which has been studied by a series of authors experimentally and clinically. In degree it may range from trivial to fatal. It is governed by 2 factors namely, the duration of ligation and the mass and character of the tissue ligated. The time limit of the local resistance to asphyxia mentioned above, can be learned only by applying the tourniquet to a mass of tissue too small to cause fatal shock even with the longest duration of asphyxia. As the writer has shown the experimental shock in animals can be standardized by ligating definite portions of the limbs for definite periods. In man fatal shock is known to result from constriction of the thigh for an uncertain time. The blocking of circulation in the upper arm (for an un-

known but obviously long time) has been reported by Cannon as a cause of fatal shock. This is the smallest mass of peripheral tissue which is known to be capable of producing fatal shock by ligation, and by comparison with animals it may be assumed that a tourniquet below the elbow could not give rise to fatal shock regardless of the time.

The activity of tissue metabolism may furnish a reason for difference in the tolerance limits for asphyxia in different species. But when the tourniquet is applied carefully in order to reduce pressure effects to a minimum the differences between the mammalian species ordinarily used in the laboratory do seem to be extreme. The leg tissues of the rat can tolerate at least 13 hours of circulatory stasis or possibly more if pressure effects could be further prevented. An experiment published elsewhere (1) illustrated the survival of a dog's leg after stoppage of circulation for 15 hours. Results in the rabbit and cat have been similar. It is not claimed that these periods represent the extreme limit of tolerance. Wilson and Roome found gangrene absent in dogs' legs after complete arrest of blood flow for as long as 20 hours, but the permanency of the survival of tissues was not demonstrated. As the human metabolism is slower than that in the smaller species, the endurance of asphyxia should be fully as long and may perhaps be longer. Cannon's report of fatal shock after 24 hours of compression of a man's thigh between logs made no mention of gangrene, and other instances of prolonged resistance can be found in surgical literature.

On the other hand, inquiry among surgeons reveals a vague belief that a tourniquet may cause sloughing if it stops circulation for more than 3 to 5 hours. This fear may perhaps have its origin in cases complicated with vascular disease, wounds, infections, or gen-

eral weakness In occasional emergencies the prolonged application of a tourniquet may be compulsory, regardless of the temporary paralysis which follows, and the ability of the tissues to withstand very long asphyxia should be better understood There is greater danger of constitutional shock, and all possible clinical observations should be collected to establish the length of time required for tourniquets in definite locations to create this danger It must be remembered incidentally that general weakness from hemorrhage, infection, or any other cause predisposes a patient or animal so powerfully that an otherwise slight shock may prove fatal

LIGATIONS OF NECK TISSUES

In a series of rats and cats, attempts were made at massive ligations of cervical tissues for periods of 2 to 8 hours The usual method was to make one vertical incision in the midline and another parallel as far to the side as possible Blunt dissection was then carried down as deeply as possible, so that finally one elastic ligature applied at the top and another at the bottom produced complete asphyxia of most of the tissue of one side of the neck, consisting of skin, muscles, thyroid, and the jugular veins and contents of the carotid sheath

No animals died as a direct result of such ligations of the vagus nerve, the jugular veins and the carotid artery, even when the procedure was repeated on the other side of the neck after 2 or 3 weeks Any cardiac disturbance seemed to be temporary or unimportant A sympathetic influence was often noticed in abduction of the eyeball, narrowing of the pupil, and contraction of the nictitating membrane The general plan was spoiled by a difficulty which has been encountered in all parts of the body in rats and which prevailed likewise in the necks of cats Ligatures applied directly in contact with the tissues, without the protection of intervening skin, tend strongly to obliterate vessels and produce necrosis in the soft tissues of small animals For this reason only the 2 hour ligations were endured, and it was impossible to learn the true tolerance of the neck tissues for asphyxia In larger species, such as dogs and man, the

vessels are larger and the tissues tougher, so that temporary ligation of the exposed tissues is more feasible Unfortunately, it was not possible to repeat experiments of this type on larger dogs Under any conditions, the influence of a wound will be to reduce the resistance to asphyxia

LIGATIONS OF TONGUE

Light rubber ligatures were placed between 1 and 2 centimeters from the tip of the tongue in a series of dogs and cats, for periods of 4 to 8 hours Certain special provisions are necessary in such experiments The tongue must not be allowed to become too dry Also, it must not be confined too completely within the mouth, where the continuously elevated temperature is unfavorable for survival It must be guarded against injury by the teeth, not only during the ligation but particularly for a number of days afterward, because the combination of swelling, paralysis, and anesthesia makes it extremely liable to injury, ranging from complete amputation to mere tooth punctures which open the way to infection and gangrene

These requirements could seldom be fulfilled perfectly, but in successful cases it was proved that the tongue can withstand at least 8 hours of asphyxia This is logically to be expected, since the organ is composed essentially of mucous membrane and muscles, and has an abundant blood supply Theoretically, if it could be ligated under strictly the same conditions as the limbs, it should withstand the same duration of asphyxia In practice, however, aside from the above difficulties, it is probable that the mucous membrane will be less resistant than skin to direct pressure, and that therefore ulceration at the zone of ligation will be more serious and will shorten the time limits

The local reaction in the tongue is also more intense than that in the limbs, the hyperemia and edema being very great Under favorable conditions they gradually subside Also, the complete paralysis which exists after a 4 to 8 hour ligation diminishes in the course of a week or more, with the result that restoration of the function of the tongue becomes complete

RESISTANCE OF PERIPHERAL TISSUES TO ASPHYXIA AT VARIOUS TEMPERATURES

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LIGATIONS OF LIMBS

SEVERAL recent papers (1) have described the effects of the application of tourniquets to the legs of experimental animals. The local effects are reactive hyperemia and inflammation and paralysis and anesthesia of variable degree and duration, all governed by the length of time of the ligation. Excessively prolonged application of the tourniquet necessarily results in gangrene, from 2 causes, (a) lack of blood supply for a time longer than that for which the tissues can withstand asphyxia, (b) direct pressure effects in the zone of ligation in the form of ulceration, necrosis, infection and thrombosis followed by gangrene of the more distal parts. These secondary results of pressure commonly occur sooner than those from the lack of blood supply mentioned under (a), hence, it is not always a simple matter to determine accurately the maximum duration of asphyxia which can be followed by complete and permanent recovery.

The constitutional effect of tourniquet application is a pure and typical form of secondary shock, which has been studied by a series of authors experimentally and clinically. In degree it may range from trivial to fatal. It is governed by 2 factors, namely, the duration of ligation and the mass and character of the tissue ligated. The time limit of the local resistance to asphyxia, mentioned above, can be learned only by applying the tourniquet to a mass of tissue too small to cause fatal shock even with the longest duration of asphyxia. As the writer has shown the experimental shock in animals can be standardized by ligating definite portions of the limbs for definite periods. In man fatal shock is known to result from constriction of the thigh for an uncertain time. The blocking of circulation in the upper arm (for an un-

known but obviously long time) has been reported by Cannon as a cause of fatal shock. This is the smallest mass of peripheral tissue which is known to be capable of producing fatal shock by ligation, and by comparison with animals it may be assumed that a tourniquet below the elbow could not give rise to fatal shock regardless of the time.

The activity of tissue metabolism may furnish a reason for difference in the tolerance limits for asphyxia in different species. But when the tourniquet is applied carefully in order to reduce pressure effects to a minimum the differences between the mammalian species ordinarily used in the laboratory do seem to be extreme. The leg tissues of the rat can tolerate at least 13 hours of circulatory stasis or possibly more if pressure effects could be further prevented. An experiment published elsewhere (2) illustrated the survival of a dog's leg after stoppage of circulation for 15 hours. Results in the rabbit and cat have been similar. It is not claimed that these periods represent the extreme limit of tolerance. Wilson and Roome found gangrene absent in dogs' legs after complete arrest of blood flow for as long as 20 hours but the permanency of the survival of tissues was not demonstrated. As the human metabolism is slower than that in the smaller species, the endurance of asphyxia should be fully as long and may perhaps be longer. Cannon's report of fatal shock after 24 hours of compression of a man's thigh between logs made no mention of gangrene, and other instances of prolonged resistance can be found in surgical literature.

On the other hand inquiry among surgeons reveals a vague belief that a tourniquet may cause sloughing if it stops circulation for more than 3 to 5 hours. This fear may perhaps have its origin in cases complicated with vascular disease, wounds, infections or gen-

eral weakness In occasional emergencies the prolonged application of a tourniquet may be compulsory, regardless of the temporary paralysis which follows, and the ability of the tissues to withstand very long asphyxia should be better understood. There is greater danger of constitutional shock, and all possible clinical observations should be collected to establish the length of time required for tourniquets in definite locations to create this danger. It must be remembered incidentally that general weakness from hemorrhage, infection, or any other cause predisposes a patient or animal so powerfully that an otherwise slight shock may prove fatal

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INFLUENCE OF ELEVATED TEMPERATURE

Elevations of only a few degrees of temperature multiply the effect of asphyxia, so that either local gangrene or fatal shock may result within a fraction of the time required at room temperature.

An illustration is furnished by a rat which had one hind leg ligated and immersed in water at 38 to 39 degrees C for 2 hours. The red cell count rose from 7,500,000 before, to 8,750,000 at the end of ligation, presumably because of warmth and struggling. After release, the hyperemia and swelling were much greater than after a 2 hour ligation at room temperature. Within 1½ hours the rat was in a state of collapse, with red cell count up to 10,750,000. An injection of 2 cubic centimeters of saline was given intravenously, and 20 cubic centimeters in addition was injected into the peritoneum and under the skin. Nevertheless death occurred 45 minutes later, with a red cell count of 10,250,000.

Examples of gangrene which occurred after brief ligation at elevated temperatures are given elsewhere (1).

It may be difficult to convince clinicians that such severe injury to bloodless parts is produced by temperatures which feel merely lukewarm to the hand and which are well within the range of fever which can be tolerated almost indefinitely when circulation is present. The erroneous ideas and exaggerated fears of surgeons in regard to the tourniquet may be based not only upon the complications mentioned above but still more upon the vicious and indefensible practice of artificially warming limbs which lack circulation. If a bare minimum of blood supply is present the dilation of blood vessels with heat gives a rational promise of benefit. But in borderline cases, it must be questioned whether this will compensate for the increase of local metabolism, with the resultant demand for an increased supply of oxygen and food materials and an increased removal of carbon dioxide and waste products. Beyond this point when the blood supply is either absent or obviously deficient, the use of any warmth whatever only invites and hastens disaster. Because of these experimental and clinical facts, the indiscriminate use of heat for dia-

betic gangrene should be replaced by a very guarded and selective use. Some surgeons already avoid its use in embolism and similar conditions, but the principle seems to be not generally understood and heeded.

INFLUENCE OF REDUCED TEMPERATURE

Reductions of the temperature of a ligated limb correspondingly reduce the local metabolism and the danger of both gangrene and shock. It is obviously necessary to avoid the destructive effect of freezing, but short of this, the lower the temperature the longer is the time for which lack of circulation can be safely tolerated.

SHOCK

Previous papers have shown that at room temperature fatal shock results from the ligation of one hind leg of a rat for 5 hours or from blocking of the aorta by abdominal ligation for 1½ to 2 hours. The following experiments illustrate the influence of temperature of about 2 degrees C.

A strong rat weighing 140 grams had one hind leg ligated in ice water for 5 hours. After release the leg flushed a pale pink but the usual intense hyperemia, local swelling and systemic weakness were practically absent. The initial red cell count of 7,260,000 was scarcely changed during the entire observation, the highest count being only 7,600,000. Because of imperfect protection of the body the rectal temperature fell very low (28 degrees C minimum) nevertheless the animal recovered easily and completely. On the other hand in ordinary shock experiments, although comfortable warmth is beneficial, artificial elevation of the body temperature does not save life.

Another very strong male rat had the abdomen ligated for 3 hours. The legs and body (including large testes) posterior to the ligature were immersed in ice water throughout the 3 hours while the anterior part of the body was artificially warmed. On release of the ligature the rat was placed in a warm chamber but nevertheless shivered as the circulation returned in the chilled parts and 30 minutes after release the rectal temperature was 27 degrees C. There was only slight weakness, and slight hyperemia and edema in

the paralyzed hind parts (in which, however, sensation was retained, contrary to the rule at room temperature) The rectal temperature gradually rose, but was only 32 degrees C $3\frac{1}{2}$ hours after release The rat remained alert, reacting normally to the environment, it drank 1 or 2 cubic centimeters of water, and no fluid was injected. The red cell count was 7,300,000 before ligation At the end of ligation, just before release of the ligature, it had risen to 9,100,000 After 30 minutes it was 8,900,000, and after $3\frac{1}{2}$ hours it was 8,370,000 The corresponding leucocyte counts were irregular, viz , 32,750, 21,300, 28,250, and 43,650 The rat survived in strong condition, until the usual bladder obstruction brought death 1 week later from hydro-nephrosis

LOCAL TISSUE SURVIVAL

Larger species were used instead of rats for the longest experiments, because of the better tolerance of changed temperatures, abstinence from food, and general strain Light amytal narcosis was used at the beginning in all cases, until the animal became accustomed to the confinement, after which it could be largely or entirely omitted The leg was passed through a suitable opening in the animal board, for immersion in ice water to a level 1 or 2 centimeters above the ligature The body of the animal above the board was kept dry, and was wrapped warmly in blankets or heated electrically Constant day-and-night watching was necessary By padding and other devices the animals were kept comfortable though immobile, and their position was changed several times in each 24 hours as a precaution against either discomfort or circulatory disturbances Immediately after release the ligated leg was dried with a towel and the animal placed near a steam radiator or in a heated box

Rabbit 1 The left hind leg was ligated about midway between the knee and ankle and immersed in ice water for 30 hours The rectal temperature fell within the first 3 hours to 28 degrees C, and afterward with better heating was kept between 33 and 35 degrees C On release the rabbit was strong, and drank water immediately. The ligated part showed the light pink color which is usual after refrigeration, but warmth returned only gradually, and slight

edema was 2 to 3 hours in developing Sensation in the foot seemed to be regained in 4 days, and after 8 days the motor paralysis had cleared up

Rabbit 2 The right hind leg was ligated about midway between the knee and ankle and immersed in ice water for $52\frac{1}{2}$ hours The rectal temperature was frequently down to 34 or 35 degrees C occasionally up to 37 degrees C Injections totaling 50 cubic centimeters of saline were given subcutaneously Upon release, the ligated leg was paralyzed and required about an hour to become warm Edema was most marked at and above the zone of ligation, comparatively slight below The rabbit remained well and strong There was no ulceration, and the local swelling and paralysis cleared up in about 1 week

Cat 1 The right hind leg was ligated about mid-thigh and immersed in ice water for 28 hours The rectal temperature remained mostly between 32 and 34 degrees C After release the circulation returned rapidly and the cat shivered violently even in a heated box Stupor was due only slightly to amytal, mostly to collapse. Edema gradually developed about the zone of ligation but was slight below it One hour after release, 200 cubic centimeters of saline was injected subcutaneously, and about 45 minutes later 150 cubic centimeters was injected under the skin and 100 cubic centimeters into the peritoneum The collapsed state persisted unchanged, the heart was weak but not excessively fast, and the respirations were strong and regular without dyspnea No notice was taken when the jugular vein was exposed $2\frac{1}{4}$ hours after release and 100 cubic centimeters of saline injected into it The strength of the animal continued to fail, and death occurred 7 hours after release The rectal temperature rose to 39 degrees C and the tissues felt hot at autopsy

The heart was found contracted but the great veins were well filled The viscera were negative The bladder contained a considerable amount of pale urine, the ligated leg was hyperemic, very slightly edematous, with liquid blood in patent vessels and no sign of necrosis or thrombosis.

Blood counts were taken before application of the tourniquet, immediately before its release, at 1 hour after release (immediately before the subcutaneous saline injection), also $2\frac{1}{4}$ hours after release (immediately before the intravenous saline injection), also 1 hour after that, and finally at autopsy All the counts during life were easily obtained from the ear, indicating sustained peripheral circulation and adequately filled vessels The red cell counts in this order were in millions 8 1, 10 7, 11 8, 7 6, and 6 6 The corresponding leucocyte counts in thousands were 9 7, 18 5, 16 0, 10 0, and 9 2

Cat 2 The right hind leg was ligated about mid-thigh and immersed in ice water The rectal temperature remained at about 33 degrees C After 49 hours a new ligature was applied below the knee, then the first one was removed, and the ice water was lowered so as to stand 1 to 2 centimeters above

the new ligature. This ligature was removed 11 hours later (making 60 hours of asphyxia for the tissues below it). The purpose of this procedure was to subject a limited mass of thigh tissue to asphyxia for a time which it was hoped might be endurable, if circulation was allowed to return only in this limited mass and was blocked from the lower leg by a new ligature. The hope was that the animal might be able to overcome this degree of intoxication within 11 hours then the ligature below the knee could be released, because a 60 hour ligation at this point does not produce fatal shock in normal animals.

A subcutaneous injection of 200 cubic centimeters of saline was given 1½ hours after release of the first tourniquet and again after 7 hours. Nevertheless, the cat weakened progressively and at the time of release of the second ligature was already unconscious with feeble pulse and rapid shallow respiration. An additional 200 cubic centimeters of saline was injected subcutaneously at this time and repeated 2 hours later. Death occurred 3 hours after release of the second and 14 hours after release of the first ligature. The rectal temperature rose to 33 degrees C. 1 hour before death.

Blood counts were easily obtained from the ear shortly after the application of the first ligature, just before its release 13½ hours after its release also just before and 13½ hours after release of the second ligature. The red cell counts in this sequence were as follows in millions: 9.2, 10.3, 11.3, 11.9 and 13.5. The corresponding leucocyte counts in thousands were 23.5, 27.5, 22.7, 18.0 and 10.6.

At autopsy, the heart and great veins were fairly well filled, the lungs congested. The viscera were negative. The greater part of the injected fluid remained under the skin. The tissues between the upper and lower ligatures appeared practically normal with only slight congestion and edema. The leg below the lower ligature was slightly darker but the vessels were patent and contained liquid blood not clots. The circulation in it was evidently not as active as usual because of the extreme prostration but there was no appearance of gangrene.

In this experiment subcutaneous saline injections were ineffectual for preventing a marked concentration of blood as indicated by the rising red cell counts. The other symptoms were those typical of shock, except for the slight fever in contrast to the usual subnormal temperature. The edema of the ligated parts was so slight that the discharge of blood plasma must have occurred chiefly into the general body tissues. The experiments agree with the results of the shorter ligations at room temperature in apparently necessitating the assumption of a chemical substance from the ligated tissues.

The reason for the dangers of thigh ligations have been explained elsewhere being due chiefly to large masses of deep tissue which are inadequately chilled with the method used.

Cat 3. A tourniquet was applied near the left ankle and the foot immersed in ice water for 54 hours. With blanket coverings the rectal tempera-

ture within the first 12 hours fell to as low as 30 degrees C. but under electric heat it was afterwards kept between 33 and 35 degrees C. Because of the rise of the red cell count during ligation 200 cubic centimeters of saline was injected subcutaneously shortly before release of the tourniquet. The cat retained good strength and recovered uneventfully. The ligated foot swelled to about twice its normal size, but ulceration was limited to a part of the skin which suffered from direct pressure in the ligation and aside from temporary paralysis there was no disability in the foot below the ligature.

Blood counts were taken before the application of the tourniquet, 2 hours before release, 5 hours and 14 hours after release. The red cell counts in this order in millions were 7.8, 11.3, 11.7, and 7.8. The corresponding leucocyte counts were in thousands: 23.1, 18.7, 10.8 and 14.5.

As fasting cats exhibit no marked thirst or desiccation in the course of several days and this cat drank only a trifle after release the concentration of blood under the conditions of ligation was probably related to shock. After release there was an intense local reaction in the ligated part but the mass of tissue was too small to give rise to any dangerous constitutional effects.

A dog weighing 10 kilograms, underwent ligation of the right hind leg in the lower third of the thigh with immersion in ice water for 24 hours. The rectal temperature was found once down to 32 degrees C. but mostly was kept at 34 to 35 degrees C. Twice during ligation the dog drank thirstily and thus evidently prevented concentration of the blood. Nevertheless he was very weak and listless after release perhaps from simple exhaustion he drank water repeatedly but refused food until 24 hours after release. During this time the rectal temperature remained at 34 degrees C.

Though the tourniquet had embedded itself deeply in the tissues the circulation returned promptly so that the leg was warm to the toes within 5 to 10 minutes. The dog then showed signs of pain (which is not indicated in most animals). Hard inflammatory swelling developed at the zone of ligation but edema in the leg below it was very slight. Paralysis and anesthesia were complete.

Blood counts were taken immediately after application of the tourniquet immediately before its release, at the depth of prostration 1 hour after release and in the stage of recovery 7 hours after release also 3 days later. The red cell counts in millions were serially as follows: 7.25, 7.5, 6.95, 5.7 and 5.0. The corresponding leucocyte counts were in thousands: 12.25, 30.0, 26.5, 14.3 and 20.0.

Paralysis, anesthesia, hyperemia and slight edema, without ulceration or necrosis, persisted in the ligated part of the leg. All these diminished during several days except the paralysis. After 5 days the dog could evidently feel pin pricks in the lower leg but there was the usual longer delay in motor recovery so that complete use of the leg was regained only after 10 days.

SUMMARY AND CONCLUSIONS

1 The period for which peripheral tissues can survive when the blood supply is stopped by a tight tourniquet at room temperature is found experimentally to be as follows for the legs of rats, rabbits, cats, and dogs, 13 to 15 hours or longer; for the tongue in cats and dogs, 8 hours or longer, for the neck tissues in rats and cats, only 2 hours, because of the complicating influence of the wound and tourniquet pressure on the exposed tissues especially in small species

2 Slight elevations of temperature (within ordinary febrile limits, or to a degree which feels only comfortably warm to the hand) multiply the effects, so that local gangrene or fatal shock may develop after only a fraction of the time of ligation that is tolerated at room temperature

3 Reductions of temperature greatly reduce the dangers of ligation as regards both

gangrene and shock Whenever the temperature can be efficiently maintained at about 2 degrees C, the limbs can survive asphyxia for a long period, the maximum of which has not been accurately established but which is certainly more than 50 hours

4 The experiments with elevated temperature warn against the indiscriminate use of artificial heat in conditions of local anemia It is hoped that the experiments with reduced temperature will find some clinical applications

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THE PATHOLOGIC BASIS FOR SWELLING OF THE ARM FOLLOWING RADICAL AMPUTATION OF THE BREAST

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THE most serious postoperative complication of radical breast amputation, regardless of the type of incision, is swelling of the arm. The swelling may be of a brawny type with evident thickening of the skin, or it may be of the soft type with thin, shiny skin. There is a wide variation as to the time of onset of this complication. It occasionally occurs in patients with malignancy of the breast even before surgical interference, but is rare during the immediate postoperative convalescence period. In the majority of cases it occurs between the third and sixth month after operation, but in a few it will not be noted for even a year or longer. Concomitant with the onset of the swelling there is often some evidence of a recurrence of the malignancy. There may be a mass in the axilla, an enlargement of cervical lymph glands, or a nodule in the scar. There may be pulmonary symptoms, such as cough, pain in the chest or hemoptysis. In some a definite history of recurrent lymphangitis or cellulitis preceding the onset of the edema may be obtained. In still another group the swelling will be found to be coincident with the return to normal activity and the use of the arm in arduous tasks. Finally, this complication may occur without any premonitory signs or symptoms. Once the swelling occurs, it may be persistent and progressive, until the extremity becomes enormous in size. It may be intermittent in character, swelling during the period of activity and dependency of the arm, and subsiding during rest and elevation. It may progress to a certain stage and remain stationary, not being affected by activity, dependency, rest, or elevation of the limb. Usually the entire extremity is enlarged, but in some the posterior portion of the upper arm is involved out of proportion to the other parts. There

is usually some disability of the limb and this may progress to complete incapacitation. Pain is a common symptom accompanying the swelling. It may be due to the increased tension of the edematous tissues or it may follow direct involvement of the brachial plexus.

From the wide variation of clinical signs and symptoms it is evident that there are several types of swelling of the arm following radical removal of the breast. Furthermore, all of these types cannot be explained on a single pathologic basis. It has long been recognized that the swelling may be caused by lymphatic blockage or venous obstruction. The experimental work of Halsted and his associates, Reichert and Bidgood demonstrated to their satisfaction the importance of lymphatic obstruction in the production of the edema. Halsted concluded that infection of the operative field leads to recurrent lymphangitis and lymphatic obstruction which resulted in swelling of the arm. To this condition he applied the term "elephantiasis chirurgica." This excellent study provided an explanation for one form of postoperative swelling of the arm. It has been generally accepted as the cause for all cases and the role of venous obstruction has received little attention.

There is a striking difference between the edema of pure lymphatic blockage and that produced by venous obstruction. However, it is difficult, particularly in the chronic stages, to differentiate between these forms by clinical observation alone. Vasography or the direct visualization of the vessels in the living subject, has provided a new approach to the study of the pathology of the peripheral blood vessels. After the injection of an opaque medium into either the arterial or venous systems of an extremity the vessels can be visualized in the x-ray. By applying this method of study to the venous system of the upper ex-

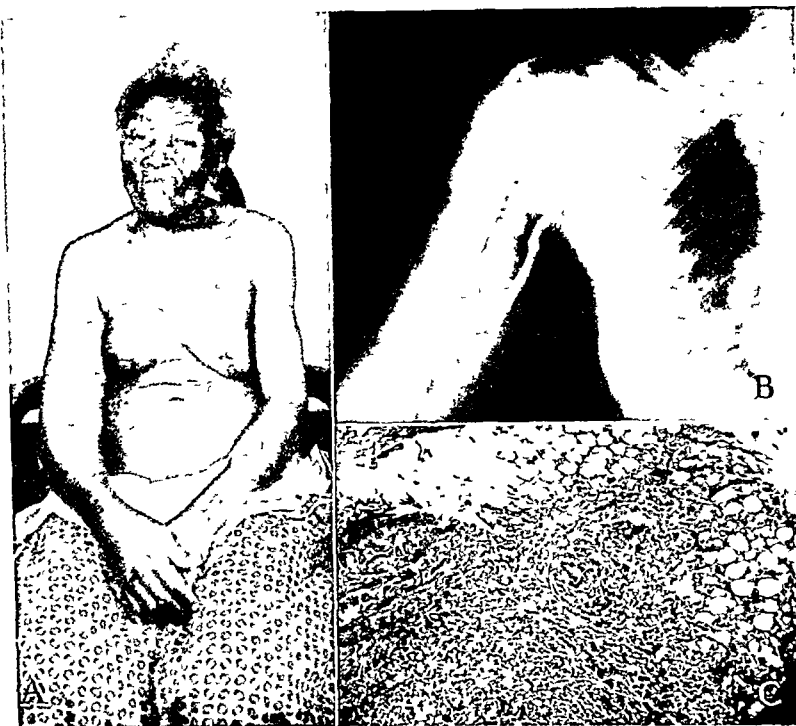


Fig 1 Primary lymphatic edema A, Photograph showing pre-operative brawny edema of right arm B, Venograph showing axillary vein intact C, Low power photomicrograph showing invasion of carcinoma into subcutaneous tissue of arm (section taken from elbow region)

tremity in postoperative swellings of the arm, one can determine the presence or absence of venous obstruction. When supplemented by venous pressure studies one can ascertain the rôle of venous occlusion in the production of the edema

In a recent communication we reported the venographic findings in 20 cases of swelling of the arm following radical removal of the breast. From these observations we classified the cases according to the primary cause of the edema into (1) lymphatic obstruction, (2) venous obstruction, and (3) lymphatic and venous obstruction. Since that publication we have had the opportunity of studying 26 additional patients, or a total of 46 cases of swelling following operation. Twenty-two patients who did not experience swelling of the arm after operation have been studied in order to determine the possible extent of venous obstruction that may exist before

edema occurs. We have also supplemented the venographic studies with venous pressure determinations in a series of cases as a confirmatory test. These studies have proved valuable as a means of differentiating between the several forms of swelling of the arm following radical breast amputation. Furthermore, we are now able to draw more definite conclusions as to the pathologic basis for the three types of postoperative edema, namely, lymphatic edema, venous edema, and lymphatico-venous edema.

LYMPHATIC EDEMA

Pure lymphatic edema is of a brawny, persistent type, which is only partially reduced by rest and elevation of the arm. The skin is firm and pits slightly on pressure, but does not wrinkle in the pit. It is the least common form of edema of the arm following radical removal of the breast.



Fig 2 A Recurrent carcinoma with massive swelling of the entire arm B, Venogram showing complete obstruction of basilic axillary and subclavian veins (proved by autopsy) Only cephalic vein remains C Collaterals are developing over shoulder Venous pressure 75 centimeters of water C Section of subclavian vein showing occluding thrombosis

In our series the swelling in approximately 10 per cent of the cases was due primarily to lymphatic obstruction. It is necessary to block both the superficial and deep lymphatic systems of the arm to produce edema. The lymph circulation of the arm is readily readjusted after simple removal of the axillary lymph glands. Sufficient lymphatic obstruction to cause edema of the arm may result from recurrent or persistent infection of the soft tissues of the upper arm, axilla and shoulder. The source of the infection may be from the fresh operative field, from open injury to the healed scar, or from recurrent carcinoma with ulceration on the skin surface. These patients frequently present a history of recurrent lymphangitis or cellulitis of the arm and shoulder. The infection may be accompanied by chills and fever and pain in the arm, neck, and shoulder. The cervical lymph glands often become enlarged, tender and painful during the period of active lym-

phangitis. Swelling of the arm is likely to occur with the initial attack, but may disappear as the infection subsides. After recurrent attacks the edema becomes persistent and is little affected by rest or elevation of the arm. The direct extension of the carcinoma into the skin and subcutaneous tissue of the arm may lead to sufficient blockage of the lymphatics to produce edema, but this form of lymphatic obstruction is not as frequent as the inflammatory form. Such an example is shown in Figure 1. The scarring of the tissues of the thorax, the axilla and the shoulder from the operation, plays a minor rôle, if any, in the production of this form of edema.

The venographic findings in the pure lymphatic edema cases show that there is no obstruction of the large venous trunks. There is no evidence of collateral venous circulation, nor is there any abnormal elevation of the local venous pressure. The swelling may com-



press the small tributaries but the large venous trunks remain intact and therefore the venous pressure will not be materially affected

EDEMA FROM VENOUS OBSTRUCTION

The edema produced by venous obstruction is of the soft, pitting type. The skin is thin and tense and there is wrinkling of the pitted portion. Approximately 90 per cent of the cases of edema of the arm following operation are due primarily to venous obstruction. After the edema occurs there is a retardation of lymph flow with changes in the lymph vessels. If the edema is not soon relieved there is increasing evidence of lymphatic obstruction. These cases then gradually merge into the lymphatico-venous type which will be discussed later. Those cases resulting from venous obstruction that have maintained the soft, thin, shiny skin, which pits deeply on pressure have been classified as the simple venous type. Those cases resulting from venous occlusion, which has been followed by sufficient lymphatic obstruction to produce



Fig 3 Postoperative venous edema. Recurrent carcinoma. Venograph shows complete occlusion of axillary and subclavian veins. Venous pressure 140 centimeters of water in affected arm, and only 10 centimeters in the normal arm. Note soft pitting edema of hand.

the characteristic thickening of the skin, have been classified as the lymphatico-venous type of edema. In the simple venous edema group, the effect of rest and elevation of the arm varies according to the extent of the obstruction and the height of the local venous pressure. In mild degrees of occlusion the edema may temporarily disappear by rest and elevation of the arm, but with very extensive venous obstruction this measure is not likely to bring any relief.

Simple ligation of the axillary vein at one point apparently will not produce edema, provided sufficient tributaries are left intact. Sudden occlusion of the axillary and subclavian veins by a thrombus produces massive edema of the entire arm and hand. This has been repeatedly shown in cases of primary thrombophlebitis and in the so called effort thrombosis. In these cases the edema disappears within a few days to several weeks. The disappearance of the edema is due to the development of a collateral venous circulation. From a study of 6 cases of primary axillary and subclavian vein thrombosis by means of venography we have found that collaterals develop rapidly, because the tributaries are intact and the tissues through which they run are soft and pliable. The important tributaries taking part in the development of the collaterals are the superficial system over the anterior shoulder and chest, the veins following the thoraco-acromial artery, the long thoracic, and the cephalic vein. In some



Fig. 4 Complete occlusion of axillary vein by benign scar formation. Edema developed about 2 months following operation and has persisted for 5 years. No evidence of recurrence of malignancy. Arrow indicates point of venous occlusion.

cases there is a recanalization of the axillary and subclavian veins. Apparently the veins in the scapular region take little part in the development of collateral vessels.

Obstruction of the axillary or subclavian vein following radical breast amputation may cause more serious consequences because certain obstacles interfere with the development of collateral vessels. The operation lays the foundation for the prevention of the formation of collateral venous circulation. Radical breast amputation implies the complete excision of the breast, the pectoral muscles and the removal of all regional lymphatics. Therefore, certain important venous tributaries are always sacrificed. Those vessels supplying the pectoral muscles of course are destroyed and the superficial vessels over the anterior axillary fold and breast region are divided. Often the long thoracic vein must be sacrificed, and occasionally the cephalic vein is divided. Even with such extensive dissection the venous return usually readily compensates and edema is seldom an immediate complication. It is not the actual sacrifice of

venous tributaries at the time of operation but the later scarring of the tissue with further venous obstruction that is important in the production of edema. Let me repeat, the operation lays the foundation for preventing the development of adequate collaterals. The late scarring or recurrence of the malignancy produces the actual constriction or obstruction of the large vessels that leads to increased venous pressure and edema.

By far the most common cause of venous obstruction is a recurrence of, or better, a continuous spread of the breast malignancy to the axillary and subclavian veins. The new growth may simply compress one or both of these veins. A small nodule is sufficient to cause complete obstruction, especially when the arm hangs by the side, because of the unyielding scar tissue resulting from the operation. The tumor growth may encircle and cause a strangulation of the large venous trunks in the axilla or it may spread along the subclavian vein and constrict it. In some cases the spread of the carcinoma may be from within the chest and produce an obstruction of the subclavian vein. By compressing the large trunks the venous flow may be so slowed that thrombosis results and thereby produces a complete and widespread occlusion (Figs. 2 and 3). The tumor cells may infiltrate the vein wall and produce sufficient irritation of the intima to cause a thrombosis or they may actually invade the vein and produce complete obstruction by filling the lumen with the new growth.

The axillary vein may be constricted or completely occluded by benign scar tissue (Fig. 4). This may occur within a few weeks or may not occur for several months or even a year following the operation. The most common incision followed by scarring sufficient to obstruct the axillary vein of course, is the one in which the axilla is actually involved. The original incision may seem sufficiently removed from the axilla but on contraction may actually fall in it. The scar may then incarcerate the vein or may cause obstruction when the arm hangs by the side because of its unyielding nature. Scars from incisions that do not directly involve the



Fig 5 A, left, X-ray of chest with arms extended to right angle position. Skin of floor of axilla covered with barium to render it opaque. *a1*, Axilla of side on which a radical breast amputation has been performed. Arrows indicate depth of axilla. *a2*, Normal axilla. Note depth of axilla as



indicated by arrows. B, Same case with arms by side. *b1*, Side operated upon, showing fixation of floor of axilla. Note the narrow space between arrows. *b2*, Normal side showing shift of floor of axilla downward and depth of axilla.

axilla may so narrow this space that the veins become constricted, especially when the arm is dependent. In the normal subject there is a considerable shift in the position of the axillary vein when the arm is moved from an angle of 90 degrees to complete adduction (arm by side). The vein moves downward with the pectoral muscles and the floor of the axilla, from a straight course to an obtuse angle (Fig 5). Radical breast amputation produces a narrow and shallow axilla and the skin of the floor becomes partially or completely fixed to the chest wall, so that when the arm is brought to the side the vein may not form an obtuse angle but an acute one, even to the point of complete occlusion (Fig 6). This is the position in which the arm is held the greater part of the time and it may be permanently fixed in this position by scar tissue extending from the upper arm to the chest wall. Occasionally the development of a large fat fold in the axilla will cause obstruction of the axillary vein when the arm is dependent.

As the main venous trunks become constricted or completely obstructed by any of the methods mentioned, the blood attempts to find other pathways. The operation by its nature has removed many of the tributaries, and the extensive scar has blotted out the important superficial routes. The result is inadequate collateral formation, increased venous pressure, and finally edema and swelling of the extremity. Venographic studies in

these cases will reveal the site of obstruction of the axillary or subclavian veins, the back flow of the opaque medium into the tributaries, and the development of new venous channels. When the obstruction lies proximal to the entrance of the external jugular vein into the subclavian vein the actual point of occlusion may not be visualized, but the back flow into the tributaries and collaterals will be shown. In such cases venous pressure determinations become invaluable. The normal venous pressure in the arm at heart level ranges up to 12 centimeters of water. Krogh et al found that in normal subjects fluid was filtered into the tissues of the forearm when the venous pressure exceeded 15 centimeters of water. Above an average venous pressure of 17 centimeters of water the rate of filtration was directly proportional to the increase in venous pressure. However, there may be no clinical evidence of edema until the venous pressure is much higher. We have seen cases in which the venous pressure was persistently as high as 25 centimeters of water before pitting edema occurred. In our series of patients who did not experience edema following operation and on whom venous pressures were recorded, there was no abnormal elevation of the pressure. In those patients who suffered edema and who showed evidence of venous obstruction, the pressures have ranged from 19.5 to 140 centimeters of water, the average being 53 centimeters of water. Generally speaking, as the degree of venous

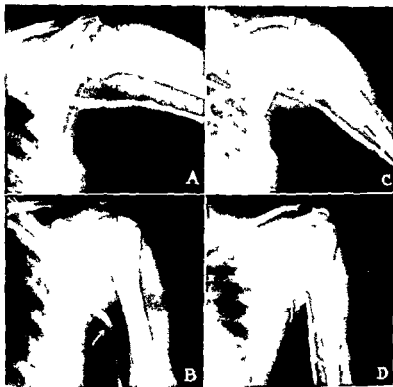


Fig. 6 A Venograph showing normal axillary vein with arm extended B Venograph of same patient with arm by side Note obtuse angulation of axillary vein as indicated by arrow C Venograph of axillary vein in patient who develops edema of the arm only when the arm is dependent Note that with arm extended the vein is not occluded D Venograph of same patient with arm by side Note complete occlusion of axillary vein (arrow) and backflow of opaque medium into the tributaries.

obstruction increased there was a concomitant rise in the local venous pressure and a greater increase in the edema of the arm

EDEMA FROM LYMPHATIC VENOUS OBSTRUCTION

This form of edema is characterized by thickening of the skin with pitting edema that is only slightly affected by rest and elevation of the extremity. Recently McMaster has made some valuable contributions on the cutaneous lymphatic circulation. By injecting patent blue V, a vital dye intradermally the cutaneous lymphatics were rendered visible and then by making serial photographs of these injected vessels he was able to record the actual changes that occurred in the lymphatics under normal and pathological con-

ditions. In this study he made two observations that seem to have some direct bearing on the mechanism of the development of postoperative lymphatic venous edema of the arm. He found that in the intact, resting dependent limb lymph does not flow in the cutaneous lymphatics. He also showed that in cardiac edema the cutaneous lymphatics were extremely dilated that the valvular system was incompetent, and that the lymph flow had ceased. The edema resulting from simple mechanical venous obstruction is similar to cardiac edema both physically and chemically, and in the manner in which it is produced. Therefore it seems logical to assume that in edema of the arm resulting from venous obstruction the lymphatic circulation undergoes the same changes as occur in car-



diac edema. Accepting this assumption, the first step then in the production of the lymphatico-venous type of edema is obstruction of the venous system by one of the methods mentioned above. The obstruction of the large veins causes an increase in the local venous pressure and because of the lack of adequate collateral pathways, this pressure is maintained and edema results. Once the edema has occurred there is a dilatation of the lymphatics, an incompetency of its valvular system, and a cessation of the cutaneous lymph flow. Dependency of the arm, the position in which it is held most of the day, acts to maintain the elevated venous pressure and prevent any emptying of the lymphatics. If these conditions are not soon relieved, the skin takes on the characteristic thickened and coarse appearance. We then have a condition similar to the "milk leg" which follows thrombosis of the deep veins of the thigh and pelvis. Infection is prone to develop after lymphatic and venous obstruction, and it may be the cause of further lymphatic blockage as well as an increase in the swelling (Fig 7).



Fig 7 Lymphatico-venous edema. Primary obstruction of axillary vein. Secondary lymphatic stasis. Recurrent cellulitis and lymphangitis.

The venographic studies and venous pressure determinations reveal the same findings as those found in the group presenting simple venous edema.

SUMMARY

Simple lymphatic edema is the least frequent cause of swelling of the arm after radical breast amputation. This form of edema may result from recurrent lymphangitis, cellulitis, or skin metastases. The deep veins of the arm are not primarily involved and remain patent.

Edema resulting from obstruction of the axillary and subclavian veins is by far the most common cause of swelling of the arm following operation. The most frequent cause of the venous obstruction is a recurrence of the malignancy along the course of these veins. In some cases the venous occlusion results from benign scar formation. In others the axillary vein is occluded by the sharp angulation of its course when the arm is dependent because of the fixation of the floor of the axilla. The venous obstruction produces a local increase in the venous pressure and fluid escapes into the tissues. Lymphatic stasis is a secondary result of the venous obstruction and if prolonged will lead to permanent blockage of the lymphatic flow. Infection is prone to develop and may lead to further obstruction and cause a greater degree of swelling. The skin may then become thickened and present the typical picture of lymphatic edema.

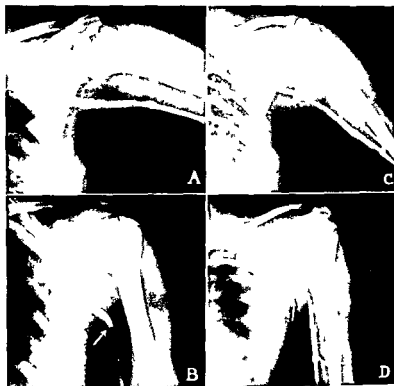


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CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF KANSAS SCHOOL OF MEDICINE

TOTAL RECONSTRUCTION OF THE AURICLE

EARL C PADGETT, M D, F A C S, Kansas City, Missouri

IN SO FAR as the individual with a major deformity of the auricle is concerned, the reasons for its reconstruction may be threefold: (1) To promote economic efficiency, (2) to alleviate a psychiatric defect, and (3) to give personal satisfaction. The prejudiced attitude of employers and associates often promotes an economic impasse. Whipping the defense reaction against the onslaught of a cruel environment is not a pleasurable pastime even if one is capable of such a reaction. But if one be so unfortunate as to fail in readjustment and the negative surmounts the positive ego, inadequacy to environment follows. The knowledge that one is presentable socially may be a great boon to a sensitive, tried, and sore spirit. Therefore, it can not be said that an adequate procedure which tends to abrogate these reactions, even without other objectives, does not entail in its accomplishment a beneficent craft.

Besides making a report on 4 total reconstructions of the auricle, 1 of which has been observed for 10 years, I wish herein to present a plan for the reconstruction of the external ear which may be performed with safety for the patient in 3 operative sittings with a total hospitalization period of less than 3 weeks. The hospitalization period should be about 1 week for the first stage. After this, an interval of about 2 months should supervene before the second stage. The second operation should keep the patient in the hospital less than 1 week if all goes well. Finally, after an interval of a month, or more if desirable, the third operation is performed. The hospitalization period following the third stage should not be more than 4 days. Any slight subsequent trimming operations can be carried out at the outpatient department of the hospital or at the office, depending upon preference or facilities.

Probably all reconstructive surgeons will readily admit that the problem of reconstructing the auricle is one to try the ultimate skill and technique of the surgeon. In 1919, J. S. Davis ex-

pressed the opinion that "the possibility of successful plastic reconstruction is doubtful and at best the cosmetic results are only fair." In 1929, A. D. Davis remarked that "many attempts at correction have resulted in an end result that looked more like a cabbage than an ear." Lockwood (1929) commented that "the most difficult feat in plastic surgery is reconstruction of the congenitally absent ear." J. C. Beck, in 1930, stated that "the great difficulty is to obtain a good cosmetic result when the external ear is more than two-thirds absent. Surgery, however, has not proved equal to the task. The long, tedious, multiple procedures do not produce results that are esthetically acceptable and only serve to substitute monstrosity for deformity." As late as 1937 Gillies observed that "The study of one's own and other surgeon's actual results reveals an undisputed disappointment in the cosmetic results obtained by these methods."

Within the past decade A. D. Davis (1929), Lockwood (1929), Beck (1930), Pierce (1930), New (1931), Bettman (1934), Eitner (1934), Gillies (1937), and others have presented cases and methods for reconstruction of the auricle. Most of these represent auricles rebuilt following loss of a lesser or greater part of the helix and the antihelix. If one may judge from the published photographs, however, the reconstructions shown by Pierce and Gillies are rather superior.

Thus, at the present time before a surgeon attempts to reconstruct an auricle he should ask himself 2 questions: First, can I build an ear which from the cosmetic standpoint is presentable and therefore of some satisfaction to the patient? Second, can I do it in a sufficiently limited number of operative procedures to make the procedure a practical one to which the patient is wise to submit himself?

MATERIAL REQUIRED

The normal ear has for structural support two irregular semilunar shaped fibrocartilaginous

A carefully taken history and a thorough examination will give valuable information regarding the cause of the lymphatic or venous obstruction. Venographic studies and local venous pressure determinations will be of value in ascertaining the rôle of venous obstruction as a causative factor in the production of the edema.

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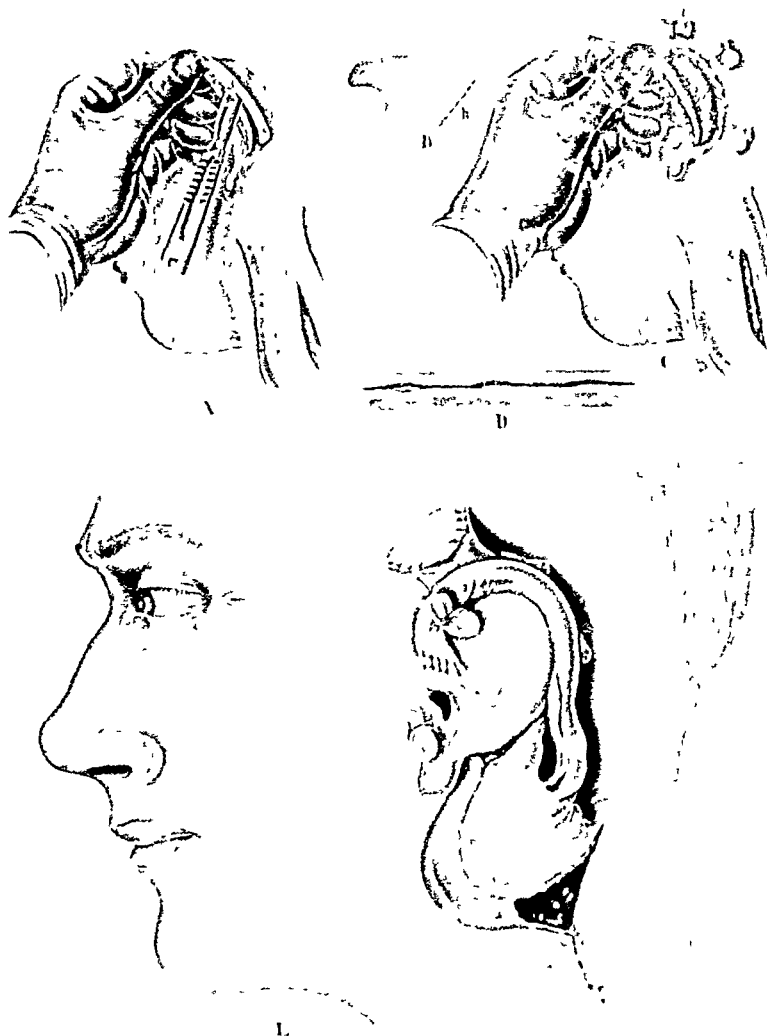


Fig 2 An incision is outlined posterior to the cartilaginous mass previously buried, A The anterior skin flap and the cartilaginous mass are turned forward after the cartilage is dissected free from the periosteum of the bone, g, on which it previously has been laid All along the circumference of the posterior edge of the semicircular cartilaginous transplant is trimmed a wedge shaped piece of cartilage with the base of the wedge posterior, f, h The tubed flaps previously prepared on the neck are cross-cut a second time at their distal ends The distal end of the large tubed flap is unrolled This flap is used to cover the posterior part of the new ear or, in other words, the posterior part of the cartilaginous framework, C The flap is passed an inch or so above the auricle and attached to the scalp side above the ear This prevents the weight of the pedicle from pulling the ear out of position downward The small flap is not unrolled It is used to attach at periodic intervals around the anterior upper and posterior edge of the ear, D and E A skin graft held in position with a stent of modeling composition is used to cover the periosteum posterior to the new auricle This is held in place by sutures crossed above the stent at appropriate points Anteriorly, they are passed through the ear and tied on some type of form such as a small piece of rubber tubing



Fig. 1. Through either an oblique or a vertical incision the cartilages of the eighth or ninth ribs on the right side are exposed. A lead pattern is used as a guide. Sufficient cartilage is removed as shown in *a*. This cartilaginous block is hollowed out so that the shape of the cavum, the antihelix and the helix is imitated *b* and *c*. Allowance is made for the thickness of the flap which will cover the cavum. One is likely not to be sufficiently generous in allowance for the cavum. This drawing shows the incisions in the skin after the removal of the cartilaginous remnants of a malformed auricle. The mastoid region also was hollowed out. A small incision is shown posterior and above the ear through which the cartilaginous framework is inserted in a position judged to correspond in relationship as to height, angle and anterior posterior direction to the opposite auricle. Along the lateral side of the neck with the base near the tip of the mastoid process a flap is raised and tubed. This flap is split at its lower end. The smaller flap should be about 12 centimeters long and 1 centimeter wide. Each end is left attached and in the middle a narrow attachment to the larger flap of about 1/2 centimeter is left uncut for a time.

wings—the helix and the antihelix—which are after all not separated. The cartilages are thin and of rather intricate shape. In no place in the body is there cartilage that may be fashioned exactly into a replica of this natural support. The cartilage in the normal ear is covered by an anterior and a posterior layer of thin skin with little subcutaneous tissue. No exactly similar

skin exists on the body which might be used for purposes of substitution. In reconstruction therefore one can only simulate the opposite ear.

Autogenous costal cartilage is a rigid material which can be transplanted as Mangold first demonstrated in 1897 and it can be shaped roughly into a form for support. At the present time all the available evidence indicates that autogenous costal cartilage tends to maintain its original cellular structure *in situ* after transplantation for a considerable length of time at least. It is now 10 years since the completion of the first auricle presented herein (Fig. 4). Although there has been some slight shrinkage the auricle is still nearly as large as when first reconstructed. The experimental evidence at least would indicate that autogenous live cartilage shows less of a tendency to be replaced by fibrous tissue than preserved autogenous cartilage (Neuhof). Although in the human this observation has not been verified the experimental evidence is considerable that homogenous cartilage tends to cause foreign body and replacement reactions to an even greater extent than autogenous cartilage (Loeb, Neuhof).

Gillies however in a recent article (1937) reports several patients in whom he has used cartilage from the maternal ear to reconstruct the pinna and Pierce and Kirkham now are using preserved homogenous cartilage in certain of their reconstructive operations. Undoubtedly within a few years we will have definite knowledge as to the permanency of dead preserved and homogenous cartilage in the human.

As the soft tissues in the immediate neighborhood of a destroyed or rudimentary ear are too scanty to afford much bulk and too flaccid to give much stability for the formation of the new auricle an additional supply is necessary if the new ear is not to appear too small. Although almost from time immemorial skin flaps were transplanted by the so called Indian, French or Italian methods it was not until 1916 when Filatof first and then Gillies (1917) (but independently) used the tubed pedicled flap that a workable means of transplanting soft tissues in quantity became available. For the required soft tissue for reconstruction the skin of the lower neck has seemed to us in the male at least as the most applicable. This skin imitates fairly well the skin of the ear in color and in general texture if not in thickness. The distance of transference simplifies the operative procedure and it is not difficult to cover the operative area by the pedicle of the flap and a skin graft. Furthermore this area is normally covered by a man's collar. Naturally



Fig 4 Case 1. A, Photograph of young man 21 years of age with congenital malformation of the auricle. In this patient the cartilage was discarded and the mastoid was hollowed out so as to give a cavity to imitate the cavum. The skin flaps surrounding the cartilage were used to reline the depression left after the removal of the bone from the mastoid. Operative procedures were started April 25, 1928. B, Front view of patient 3 years after the completion of the new auricle, April 1, 1932. C, Lateral view of rebuilt auricle 5 years after its completion, May 4, 1934.

TYPES OF DEFORMITY AND THEIR INFLUENCE ON RECONSTRUCTION

Two types of deformities of the auricle present themselves for reconstruction, the congenital rudimentary or absent auricle and the individual in whom some trauma or disease has destroyed the auricle. Accurate statistics are not available on the prevalence of congenital malformations of the auricle. Over a period of 10 years we have records of 86 cases. Pierce states that congenital malformations of the auricle occur once in 20,000 births. Accidental deformities of the ear are usually, (1) the result of some traumatic accident (the patient shown in Figure 5, Case 2, tore his auricle off sliding down a hill on a sled), (2) those which accompany burns of the face (as a rule, following a burn, the loss is only partial), (3) those which follow operative removal of all or a goodly portion of the auricle most commonly found in elderly persons because of cancer (after this occurrence reconstruction usually is not indicated because of the advanced age of the patient).

In reconstructing the congenitally malformed auricle usually it is inadvisable to open the auditory canal or the aditus ad antrum (This matter, however, indicates a rather long story and is hardly germane to our subject.) As a rule in our experience, one should remove and discard the rudimentary cartilage and readjust the superimposed skin flaps over the area from which the cartilage was removed. In one case (Fig 6, Case

3) in which a rudimentary cartilage was larger in amount than usual, I attempted to use it as a basis of structural support for the soft tissues. The result was so unsatisfactory that finally the whole of the rebuilt ear was discarded. The auricle was finally completed after starting from the beginning, so to speak, on the second attempt (Fig 6, B).

Usually when trauma is the cause of the defect, a part of the auricle is still present. If so, the reconstructive operation should be varied accordingly. The difficulty of the reconstruction will be decreased proportionately to the amount of the ear which remains. On the other hand, a severe trauma may cause not only the destruction of the whole of the pinna but a varying amount of the tissue which surrounds the ear. This may complicate the reconstruction of the auricle, making the procedure more difficult and more prolonged. In the patient shown in Figure 7, Case 4, a large slough due to some "cancer paste" had not only removed the auricle but also the skin about the location of the auricle—especially anterior to the meatus over an area about $3\frac{1}{2}$ inches in diameter. Before one could start to build the new auricle the side of the head had to be covered with a large skin flap.

THE OPERATION

The steps in our operations have been roughly as follows:

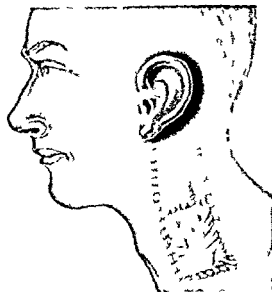


Fig. 3. The 2 flaps are crosscut near the new auricle and readjusted and sutured in place. What is left of the pedicle is unrolled, replaced and sutured to the skin of the neck as the scar is excised. *a* If the scar on the neck below the pedicled flap is not a pliable one or if there is any contracture, it is excised and the resulting raw area is covered with a skin graft. *b*

if one should consider it advisable to reconstruct an ear in the female, tissue should be obtained from elsewhere on the body. This would entail a further operative procedure.

INDICATIONS

The indications for the operation are considerably different in the female than in the male. The female can, if she wishes, hide the missing auricle or a deformed one with her hair. Before an attempt is made to reconstruct the auricle the individual should have attained his full growth, first, because one uses the size of the opposite ear as a pattern and, second, because if the individual has not attained an adult age the reconstructed ear will not become larger while in all probability the opposite one may grow somewhat.

REQUIREMENTS AND CAUSES OF FAILURE

The requirements necessary for good imitation of the normal ear are correct size, similar outline, nearly equal divergent angle from the head, the same relative height and the same position in an anterior-posterior direction and that the new auricle retain its size and shape more or less permanently.

In attempts to reconstruct the auricle satisfactorily, the causes of an unsuccessful outcome barring infection or failure of the material used for structural support to remain unbedded within the tissues without reaction, have been: (1) the inability to obtain structural support of the proper size and shape, (2) the failure to obtain adequate covering of the proper thickness, texture, and color, (3) difficulty in maintaining the new auricle at an upright level in comparison with the opposite ear, (4) the development of an improper divergent angle of the auricle from the head, and finally, (5) a tendency for folding, shrinkage, and diminution in size. When one of these stumbling blocks to success was present the new auricle could not be considered a glaring success but if more than one or all were present the qualitative result was decreased progressively in accordance with the degree of the enumerated defects.

An adequate plan is a prime prerequisite for success in reconstructing an auricle. In formulating a plan one should err on the side of too much ear rather than too little ear. Thus caution applies both to cartilaginous and soft tissue requirements. As to the latter, the flaps should be larger than one judges to be necessary. It is easier to discard than to go after more tissues. Not only when building the ear should the plan be slightly more adequate but, as a rule, it is well to plan the immediate final reconstruction to be slightly larger than ultimate requirements demand because during the first year there will be some slight shrinkage of both the soft and the hard tissues of the new auricle. Moreover the tendency to shrinkage although slight is undoubtedly present throughout life. When one takes this advice, however, the fact might be considered that a reconstructed auricle or any organ which has been reconstructed, if it is too large will attract attention because of its size alone.

Thus to recapitulate, in the development of a plan for the reconstruction of the auricle, the following desiderata are important: (1) a sufficient amount of soft tissues, (2) a type of soft tissue which can be molded to give certain contours that can not be given by rigid tissues, (3) a sufficient amount of rigid tissues, (4) rigid tissue of a size and shape which simulates most of the larger basic contours of the auricle, (5) a rigid tissue that is more or less permanent, (6) a rigid tissue that is easy to transplant, (7) a rigid tissue that will stand trauma, (8) maintenance of the proper elevation, and (9) preservation of the proper divergent angle from the head.

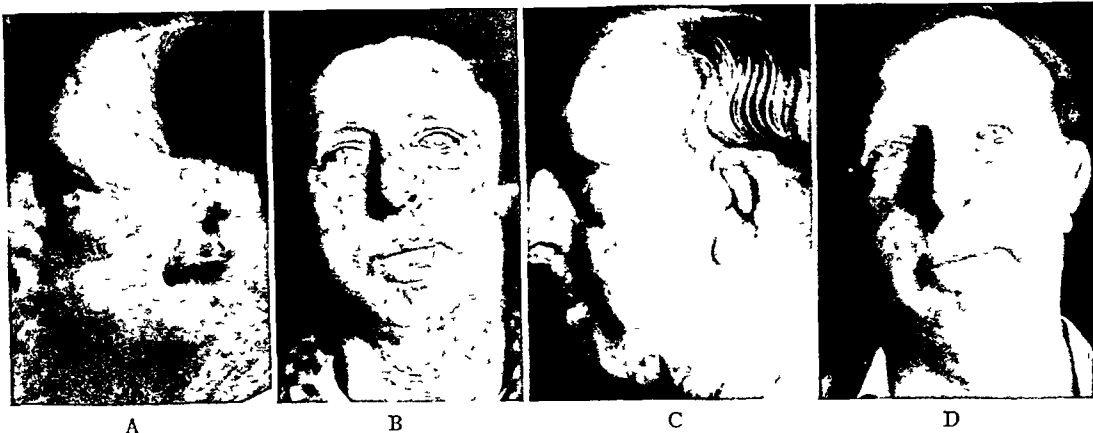


Fig 7 Case 4. A, Photograph of a man 55 years of age who had lost his left auricle due to the application of a cancer paste. He also had a seventh nerve paralysis and the lower eyelid drooped. The problem here was not only to rebuild the ear but also the foundation on which it was to rest. Before we could start to rebuild the ear, it was necessary to lay a large skin flap over the scarred area on the temporal region and the mastoid region. (As he complained considerably of his drooping lower eyelid, a full thickness skin graft was looped beneath the lower tarsal

rim and extended high on the inner canthus and the outer canthus, and the outer canthus was narrowed somewhat.) Operative procedures were started October 12, 1935. B, Front view of patient October 31, 1935, after a skin flap was applied and before the lower eyelid was raised. C, Lateral view of patient July 15, 1937, after skin flap was laid on the side of the head and the auricle was rebuilt. D, Front view of patient July 15, 1937. (Note also that the lower eyelid of patient is in a position of correction.)

and a pressure dressing consisting of wet gauze and a marine sponge is placed over it to prevent the formation of a hematoma about the cartilage.

Along the lateral side of the neck with the base near the tip of the mastoid process a flap is raised and tubed. This flap will have to be adequate to cover the posterior part of the ear and to form a small tubed roll which will be used to imitate the helix. The flap is split at its lower end as shown in the diagram (Fig 1). The smaller flap should be a narrow piece of skin and subcutaneous tissue about 12 centimeters long and 1 centimeter wide. Because of its narrowness it may be that one can not tube it well with stitches. If this be the case it is allowed to tube itself by cicatrization. Each end is left attached and in the middle a narrow attachment to the larger flap of about 1 centimeter is left uncut for a time. The temporary midway attachment helps to guarantee the blood supply. The objective is to form a bifid double tubed flap at the lower end of the flap—one narrow and one fairly large. Before the second operation both of these tubed flaps should be cross sectioned over the clavicular region and resutured back in place.

To summarize, the first operation consists of the preparation of the flap and the transplantation of a cartilaginous framework after certain advisable preliminary preparations have been carried out in the neighborhood of the meatus or

in the neighborhood of where the meatus should be. The first operation is performed more appropriately under a general anesthetic although it is not at all impossible to perform it under local anesthesia. After the first operation it is advisable to allow 2 months or more to elapse for recuperation of the tissues which have been disturbed in transplantation or have been transplanted. The dangers of infection are less if an adequate interval of time is allowed after complete healing has occurred.

Second operation. An incision is outlined posterior to the cartilaginous mass previously buried. The anterior skin flap and the cartilaginous mass are turned forward after the cartilage is dissected free from the periosteum of the bone on which it had been laid previously. All along the circumference of the posterior edge of the semicircular cartilaginous transplant is trimmed a wedge shaped piece of cartilage with the base of the wedge posterior.

The tubed flaps previously prepared on the neck are crosscut a second time at their distal ends. The distal end of the large tubed flap is unrolled. This flap is used to cover the posterior part of the new ear or, in other words, the posterior part of the cartilaginous framework. This flap is passed an inch or so above the auricle and attached to the scalp side above the ear. This prevents the weight of the pedicle from pulling



Fig 5 Case 2 A Photograph of boy 14 years of age showing lateral view of auricle which had been lost in a boating accident. Operative procedures were started April 25 1932 B Lateral view of patient taken 2 years after the auricle was reconstructed February 14 1934 C Lateral view of patient November 10 1936 (Note that some of the subcutaneous tissue has disappeared underneath the skin and the cartilage shows a few prominences)

First operation As just mentioned in the total reconstruction of a congenitally deformed auricle as a rule the rudimentary cartilaginous masses are removed and discarded. If the auricle is to be rebuilt because of a major congenital malformation the next step may be the removal of some bone about and posterior to the position of a normal meatus so that a depression in the bone is made which will imitate the cavum or even a

rudimentary meatus. The skin flaps which remain after the rudimentary cartilage and bone have been removed are applied directly to the bone to form a lining for the newly formed cavum. In the reconstruction of an auricle which has been lost due to an accident this step ordinarily will not be necessary as the external auditory meatus and the cavum will be present in fairly normal proportions and no removal, deepening or hollowing of the cortex of the mastoid bone will be necessary.

Through either an oblique or a vertical incision the cartilages of the eighth or ninth ribs on the right side are exposed. A lead pattern is used as a guide as to the amount of cartilage which will be needed. Sufficient cartilage must be obtained. A block of cartilage is removed as shown in Fig 1 a. This cartilaginous block is hollowed out so that the shape of the cavum, the antihelix, and the helix is imitated. Allowance is made for the thickness of the flap which will cover the cavum. One is likely not to be sufficiently generous in hollowing out the cartilage beneath the newly formed cavum.

Through a small incision posterior and above the ear after a fairly wide undermining of the soft tissues posterior to the meatus or the position of the meatus in a plane just superficial to the periosteum of the skull the cartilaginous framework is inserted in a position judged to correspond to relationship as to height and anterior posterior direction to the opposite auricle. The wound is closed by interrupted sutures without drainage.



Fig 6 Case 3 A left Photograph of young man 13 years of age with a congenital malformation of the auricle. Operative procedures were started February 22 1933. On this boy because there was a considerable part of the auricle present I attempted to enlarge it somewhat to make an auricle of good appearance but was unsuccessful. Therefore I started in all over again and rebuilt the ear according to the method here described. The ear was completed July 21 1934 B Photograph taken February 1 1935 6 months after its completion. At the present time the auricle needs a little reshaping at the back.

AVOIDANCE OF INJURY TO THE COMMON BILE DUCT

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IT is impossible to explain adequately to a surgeon who has not had the personal experience, the degradation of spirit with its attendant humiliation, chagrin, and remorse that comes with the realization that unwittingly, one has during the performance of a given cholecystectomy, resected, or caused a major injury to, the common or hepatic bile duct.

Some pitfalls and their avoidance in surgical procedures may be successfully learned by precept and textbook example, combined with a modicum of practical experience. Inadvertent injury of the common or hepatic bile duct is a surgical pitfall that may and does trap not only the unwary but also, occasionally, the veteran surgeon. To paraphrase the old adage "the burned child dreads the fire," one who has thus injured these ducts is far less likely to do so again.

Under such circumstances, the true surgical conscience "resteth not" until, by unremitting toil and study, it acquires an abiding knowledge not only of the normal anatomy of the region but, equally important, of the frequent anomalies of the biliary tree and its vascular system, anomalies which the surgeon should expect to be present potentially at any operation in this field. He will also acquire an utter abhorrence of what is so aptly called "grab surgery."

Nowhere, except in certain types of brain surgery, is meticulous, careful, step-by-step, dry, visualized dissection, with insurance of full surgical control, so imperative in avoiding disastrous injury to important structures.

The increasing number of operations performed for persistent biliary fistulas and for obstructive jaundice, due to man-made injuries of the common and hepatic ducts, calls for brief, lucid expositions of the detailed steps which surgeons, of long and occasionally bitter experience in this field, have adopted in their routine work in order to avoid this pitfall.

Several pathways lead to the same disastrous end-result (1) Hemorrhage from a divided cystic or anomalous artery stump (2) Anomalies of the arteries (Fig 1) (3) Anomalies of the ducts (Fig 2) (4) Unrecognized changes in the normal course of the ducts, that are due to chronic inflammatory scar retractile conditions (Fig 3).

From the Jackson Clinic

The major cause of injury to the ducts is hemorrhage from a divided cystic or anomalous artery stump. When the general surgeon first experiences this complication, the field of operation being suddenly obscured by an unexpectedly furious hemorrhage, he is prone to think, considering his estimate of the size of the normal cystic artery, that there must be an injury to the hepatic duct or a large anomalous artery. All efforts to visualize the field or control the hemorrhage through mopping are futile, directly he is applying clamps in every direction at the bottom of the blood pool in an effort to avoid a "death on the table" from hemorrhage. If his efforts are successful, he is usually faced with the predicament of not knowing which one of the several clamps applied is the critical one and decides to leave them all *in situ*, pack with gauze, and get out as quickly as possible. As soon as the artery is divided it retracts, so that its open end lies at or below the level of the common or hepatic duct, and the clamp which secures it is very likely to include in its grasp also the wall of the duct, or one of the other clamps may do so, "bite out" injuries of ducts result.

The surest way to avoid this deplorable injury is routinely to proceed with the operation of cholecystectomy so as to identify the cystic artery, and then so securely ligate it before division of the cystic duct is carried out that this mishap cannot possibly occur (Fig 4, A).

SOME CAUSES OF EMBARRASSING HEMORRHAGE FROM CYSTIC ARTERY DURING CHOLECYSTECTOMY

- 1 The unintentional division of the close-lying cystic artery when the cystic duct is divided by scissors
- 2 The unlocking of a defective cystic artery clamp
- 3 The slipping of a poorly applied ligature during or after operation
- 4 A defect in the catgut.
- 5 The crushing division of an artery by application of a clamp when the tissues are friable
- 6 The tearing away of a clamp on the cystic artery stump by the unwitting traction of an assistant
- 7 The tearing away of a clamp on an artery stump by movement of the liver when the patient suddenly strains in an effort to vomit.

the ear out of position downward. The periosteal raw surface on the cranium is covered with a skin graft.

The small tubed flap is not unrolled. It is used to attach at periodic intervals around the anterior upper and posterior edge of the ear. The fact that it is only attached at intervals of about $\frac{1}{4}$ centimeter keeps it rolled permanently and there by the form of the helix is imitated. If the tubed flap is split along its length it will flatten out to a greater extent than is desirable. To imitate the helix closely the tubed flap has to be as narrow as possible.

For pressure and fixation a modeling composition form is molded over a split skin graft. This is held in place by sutures crossed above the stent at appropriate points. Anteriorly, they are passed through the ear and tied on some type of form such as a small piece of rubber tubing.

The second operation can be performed under local anesthesia if desired. Appropriate dressings are applied. They need not be changed for a week. An interval of a month or more is allowed to elapse before the third and final major step.

Third operation. The 2 flaps are crosscut near the new auricle and readjusted and sutured in place.

What is left of the pedicle is unrolled, re placed, and sutured to the skin of the neck as the scar is excised.

If the scar on the neck below the pedicled flap is not a pliable one or if there is any contracture it is excised and the resulting raw area is covered with a skin graft.

Finally, if there is additional shaping of contour, it is done in the office under no anesthesia if an innervation has not yet developed or under local anesthesia if indicated.

If this operation were to be done on a woman, another preliminary operation would be necessary so that the flap could be taken from some area other than the neck, such as the upper chest or upper back.

CONCLUSIONS

In the 4 individuals herein presented the defect in 2 instances was of congenital origin (Cases 1 and 3). The oldest of these was built in 1928 (Case 1). At the present time the shrinkage has

been only slight. The other congenitally malformed ear was constructed in 1933 (Case 4). Case 2 suffered traumatic destruction of the auricle. It was built in 1933. Case 4 following the application of a "cancer paste" had suffered almost total destruction of the auricle along with the soft structures about the ear. The depth and extent of the slough may be appreciated when it is noted that the patient had a seventh nerve paralysis because of it. The base upon which the new ear was to rest was repaired and the new auricle was rebuilt in 1936.

The operation presented is one developed from an experience which necessarily entailed some trial and error.

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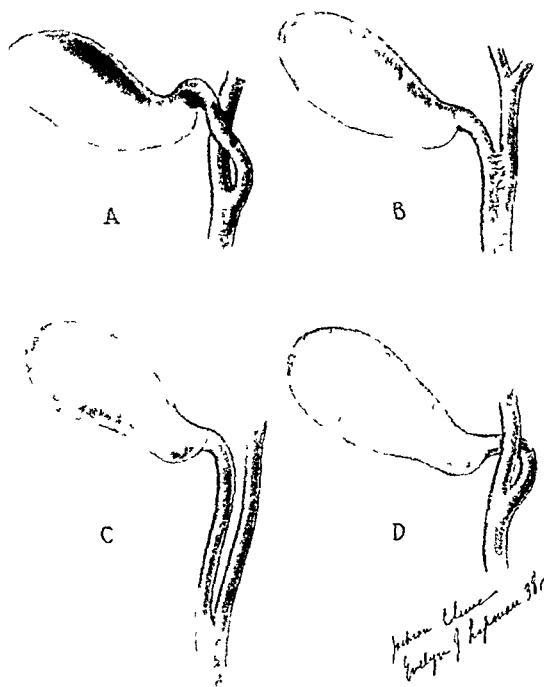


Fig 2 Anomalies of the bile ducts (after D N Eisen-drath) A, Anterior spiral type of cystic duct B, Short parallel type of union of the cystic and hepatic ducts C, Long parallel type of union of cystic and hepatic ducts D, Posterior spiral type of cystic duct

after the cystic artery is divided, it is important that its stump be ligated immediately. As soon as the third knot is placed, the ligature should be severed. We know of an instance in which, due to the slowness of the assistant in applying the scissors, a sudden straining of the patient resulted in such traction on the ligature that it was still held by the hand of the operator that it tore loose from the arterial stump.

4 An anomalous position and size of cystic artery may be present, or there may even be an extra cystic artery (Fig 1, B). Therefore, it is important always to continue carefully to clamp, divide, and ligate all tissues just as one would if he knew this certain condition were present. The surgeon should never proceed with the next step of the operation until the last one has been perfectly completed.

5 If inflammatory changes are present with juicy, friable induration around the terminal cystic duct region, it is essential to be especially careful in the application of clamps, as the jaws may bite through the cystic artery and its adja-



Fig 3 A, Easily overlooked change in course of hepatic duct due to chronic inflammatory scar retractive conditions B, Characteristic identifying vessels on common duct wall

cent tissues (Fig 4, B). A No. 2 plain catgut mass ligature placed with a dull-pointed or aneurism needle is sometimes here preferable to the clamp method.

6 If, in this situation, the cystic duct has been divided as the first step, the assistants should be warned against exerting any undue traction on the neck of the gall bladder, as such traction may result in a complete tearing through of the friable tissues containing the cystic artery. The same accident may also be produced by sudden straining of the patient in an effort to vomit while the assistant is holding the clamp in position for placing a ligature.

7 In cases in which inflammatory conditions have advanced beyond the above stage, it may be wise to be content with an "approximate cholecystectomy," assuming there is no common duct complication, and to leave the terminal third or more of the cystic duct, if there are no stones in it, undisturbed at the slight risk of future trouble, rather than to dig blindly into the tissues where anatomical landmarks are obliterated and hemorrhage is difficult to control. This conservative measure especially applies if the patient is

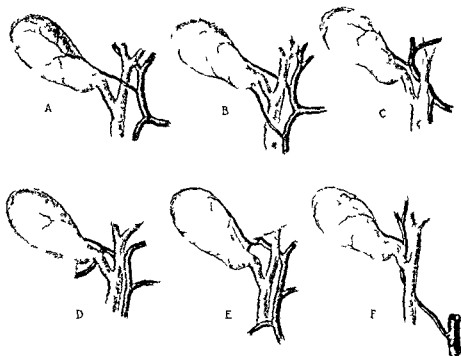


Fig. 1. Some anomalies of the arterial supply of the gall bladder (after Eisenbruch, Kyoto, and others). A The cystic artery arises from the right hepatic artery in the normal manner but crosses the anterior surface of the hepatic duct. B Two separate cystic arteries—one arising from the common hepatic artery and passing to the neck of the gall bladder, the second or accessory cystic artery arising from the gastroduodenal artery and crossing the common duct. C Either the main hepatic or only the right branch passes behind the hepatic duct making a wide arch toward the right before giving off the cystic artery. D Right hepatic artery runs parallel to cystic duct and then arches behind it at the neck of the gall bladder to enter the right lobe of the liver. Before doing so it gives off the cystic artery at the neck of the gall bladder. E Most frequent mode of origin of the cystic artery and also of an anomalous branch of the gastroduodenal artery crossing the common duct. The cystic artery usually arises from the right hepatic artery shortly after the latter passes behind the hepatic duct. (Note branch of gastroduodenal artery crossing the common duct near its lower end.) F Accessory right hepatic artery arising from the superior mesenteric artery (after Kyoto).

8 A linear slit in the hepatic artery by a violent jerk on the cystic artery clamp.

9 The tearing away of a cystic artery clamp by the end of a deep misplaced abdominal retractor.

10 The tearing through of tissues containing the cystic artery when the cystic duct is divided because of undue traction with a clamp on a gall bladder which has been mobilized base first.

As examples the following may be cited:

1 The average non-complicated interval cholecystectomy the operator having isolated the cystic duct, divides it at the proper place with scissors but this time the scissor tips nip beyond the tissues confined in the jaws of the duct clamps and divide a cloaking cystic artery. To repeat

this pitfall should be avoided by routinely first isolating the cystic duct and then before dividing it doubly clamping, dividing and ligating the tissues containing the cystic artery. This should be made an invariable rule.

2 The clamp controlling the cystic artery may be defective and may unlock just after division of the artery has been accomplished. For this reason it is essential that the clamp to be used be carefully selected and tried out before it is applied.

3 In a field cluttered with many clamps a well meaning but careless assistant may change the position of a retractor blade so that it exerts direct traction and drag on a deep-lying clamp point and tears it loose (Fig. 4 C). This clamp may be the one on the cystic artery. Therefore

6 The light beam should be directed to the best advantage. A Cameron goose-neck, intra-abdominal light may be used to advantage after the blood clots are removed.

7 A long-handled, slender-jawed artery clamp with the jaws slightly open should be placed close to where the retracted cystic artery should be.

8 The assistant should be asked to release pressure on the hepatic artery sufficiently to permit the cystic stump to bleed and then to close the artery clamp on it. If not promptly successful, the clot in the deep recess should be cleaned out and if possible the operator should proceed to inject the hepatoduodenal fold with 2 per cent novocain solution. Continuous closure of the hepatic vessels and portal vein for more than a few moments causes a marked fall (20 to 30 points) in blood pressure and if any prolonged search for the artery stump is probable, it is advisable to prevent this fall by such block anesthesia before proceeding with the search.

9 Figure 6 shows the application of an hepatic tourniquet in place of an assistant's hand. It was devised for intermittent hepatic artery control in excision of hepatic tumors and block dissection of the carcinomatous gall bladder. Experimentally, in dogs, more than 15 minutes of continuous compression of the portal vein may result in irreparable injury to the small intestine. The nut spring was devised to provide delicate, adequate pressure control without producing a crushing effect on the vessel walls. It permits intermittent closure and release of the hepatic artery and portal vein.

ANOMALIES OF THE BILE DUCTS AND ARTERIES

While every operator who undertakes the performance of a cholecystectomy owes it to the patient to have at least a cursory knowledge of this subject, some seem never to have heard of it.

Figure 1, A to E, portrays a few of the many situations which might be present in the next patient upon whom the reader operates. In 20 per cent of human beings, the blood supply of the right hepatic lobe comes directly from the superior mesenteric artery and this hepatic branch may meander even so far as to lie across the cystic duct (Fig 1, F). If mistakenly ligated for the cystic artery, high temperature and death may follow abruptly.

In instances in which the juncture of the cystic and common ducts follows a closed "Y" course (Fig 7, A), if even slight traction is maintained at the time of application of the duct clamp, the arms of the "Y" consisting of normal flaccid common duct will empty, fold together, and form an



Fig 5 Finger compression control of hepatic artery in case of furious hemorrhage from divided cystic artery.

apparent prolongation of the cystic duct, and a division here results in a complete resection of the common duct (Fig 7, B). This fact should always be borne in mind when division of what appears to be an especially long cystic duct is about to be carried out. Careful and minute inspection should reveal the true situation, as the normal common duct is thin-walled, semitransparent, greenish, and presents on its surface characteristic fine vessels. In the shad-belly type of patient, one may occasionally demonstrate to assistants the possibility of this pitfall. Veteran surgeons, when in a suitable confessional mood, are apt to refer to such an experience as most unforgettablely harrowing and inexcusable in that the essential technical procedures were not made difficult by an obscuring pathological lesion.

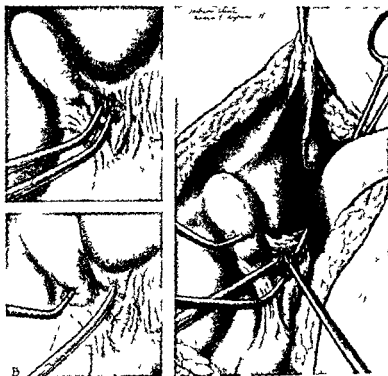


Fig. 4. A. A most important step is routinely to ligate securely and divide the cystic artery before dividing the cystic duct. B. Unwitting misplacement of a deep retractor blade in a cluttered field may result in tearing off cystic artery stump. C. Where tissues are finably inflamed an applied artery clamp may bite through the cystic artery.

of the fat bellied non mobilizable liver type, and the surgeon is handicapped by lack of skilled assistants.

CYSTIC ARTERY HEMORRHAGE

The question arises as to what should be done in the presence of a cystic artery hemorrhage. The experienced surgeon with trained assistants is usually able to retatch the cystic artery stump and ligate it without causing an injury to the hepatic ducts. Having been requested to write this article for the possible benefit of readers who may be handicapped by lack of proper hospital facilities and trained personnel, I shall describe in a simple fashion the measures that personally have been found helpful, in the hope that they may prevent the resort to steps which have in the past and certainly will if used in the future continue to produce 90 per cent of man made injuries of the common and hepatic bile ducts. Steps to control bleeding of the cystic artery stump are as follows:

1. If the furious hemorrhage persists and appears uncontrollable, the assistant with the smallest hand should be directed to take his position at the left side of the patient and to pass his open left hand into the wound until his index finger enters the foramen of Winslow and feels the pulsating hepatic artery, then with his thumb opposing to shut off this artery, making his fore arm and hand as inconspicuous as he possibly can by dragging the abdominal wall to the left (Fig. 5).

2. If the abdominal wall incision is too limited for good exposure it should be enlarged. This step is imperative.

3. All clamps should be removed.
4. The wound should be mopped out. If a suction apparatus is available it should be used for both suction and retraction in the depths of the wound.

5. The liver should be mobilized by traction clamps on the divided falciform ligament and on the gall bladder.

6 The light beam should be directed to the best advantage. A Cameron goose-neck, intra-abdominal light may be used to advantage after the blood clots are removed.

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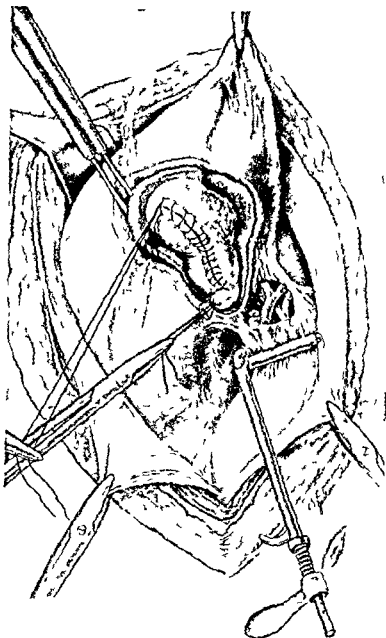


Fig. 6. Author's hepatic tumor, in the liver, for intermittent control of hepatic veins, in black, as seen from the hepatic vein, in the liver.

If there is any difficulty in ascertaining whether a ductlike structure encountered is a dilated terminal cystic duct or the common duct, it is safer to expose the common duct in its lower non-inflammatory area, open it, and pass a probe upward until the true situation is revealed, rather than to divide the doubtful structure with the hope that it is not the common duct. This situation we have encountered many times when the dilated terminal portion of the cystic duct was fused with the wall of the common duct for several centimeters (Fig 2, B). When this situation is present, the common duct tractor guide (Fig 8) serves a twofold purpose (1) it delineates the common and hepatic ducts, (2) it serves by gentle traction to elevate and bring the duct closer to the operator, thus facilitating dissection.

UNRECOGNIZED CHANGES IN THE COURSE OF DUCTS DUE TO CHRONIC INFLAMMATORY SCAR CONTRACTILE CONDITIONS

As a rule, the patients in this group are usually middle aged or elderly, with a history of chronic biliary distress. The roentgen report shows the presence of a single large, rounded gall stone. At operation, the liver is abnormally mobile, and when drawn up the condition depicted in Figure 3, A, is found.

The gall bladder stands out from the liver like a pear, its base being filled by a large stone. The lower half is completely covered by what appears to be adherent, chronically inflamed, omental tissue. The prospect is for an easy cholecystectomy. The operator begins in what he assumes to be the area of the cystic duct which he exposes, ligates, and divides, and then continues to clamp, divide, and ligate until the gall bladder is removed. Free bile is noted in the depths of the wound. The specimen is examined, and the condition depicted in Figure 3, B, is found to have been present.

I witnessed this procedure many years ago as it was being carried out by an eminent surgeon now deceased, and that experience has always come to mind when I have encountered a case of this kind. This surgeon actually lectured on the dangers of injuring the common duct while he was unwittingly resecting it! In instances like this, it is wise first to incise the gall bladder and remove the stone—there is no bile or free fluid in it—and then minutely to study the interior. If there is no opening for a probe to enter the cystic duct, then, by careful blunt dissection, enough of the wall of the common duct should be exposed to verify its abnormal position and identity by its characteristic appearance (Fig 3, B).



Fig 7 A, If a closed "Y" type of junction of cystic and common duct obtains and the tissues are non-inflamed, the slightest maintained traction on the gall bladder may result in the common duct arm folding and assuming the appearance of being a proper continuation of the cystic duct. B, If such erroneously supposed long cystic duct is clamped, divided, and ligatured, complete resection and ligature obstruction of common hepatic duct results. The gall bladder should always be examined on removal.

A possible explanation of this deceiving condition is that, in the early stages years before a huge hydrops or empyema of the gall bladder, being firmly anchored in its bed, exerted in its subsequent fibrotic changes such contractile power as to draw the hepatoduodenal fold and its contained common duct into its "Y" course to the gall-bladder site.

As it is technically far easier to repair an injury to the common duct at the time of its occurrence than subsequently, the operator should always carefully inspect the organ on its removal. If there is any question as to the cystic duct end he should re-examine the depths of the wound, and expose the common duct so as to make sure of its integrity and that it has not inadvertently been divided and closed by a ligature as is illustrated in Figure 7, B, before he carries out the procedure of closure of the abdominal wound.

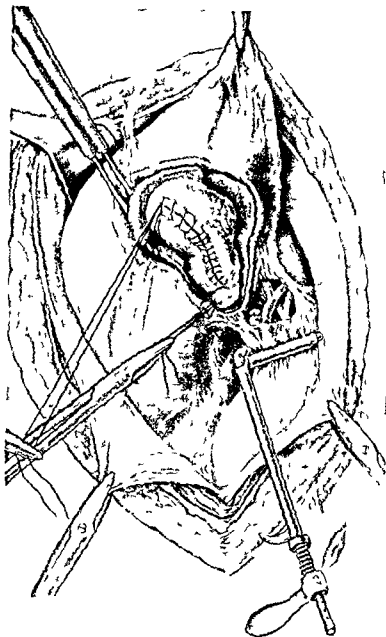


Fig. 6. Author's hepatic tourniquet device for intermittent control of hepatic vessels in block excision of certain hepatic neoplasms.

SIALOGRAPHY, ITS TECHNIQUE AND APPLICATION IN THE ROENTGEN STUDY OF NEOPLASMS OF THE PAROTID GLAND

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THE term sialography may be defined as the roentgen visualization of the parotid or submaxillary glands after the injection of a radiopaque substance into their respective ducts. The entire duct system, and also the gland parenchyma, can be studied, therefore, by this method in a way comparable to lipiodol studies of other inaccessible organs. In recent years this procedure has been used routinely at the Memorial Hospital and has proved itself a valuable diagnostic adjunct.

This report is concerned with the results of a sialographic study of 23 normal parotid glands and 76 cases of neoplastic disease of the parotid, and includes a description of a method of injection, the behavior of the lipiodol in normal ducts and glands, the roentgen findings in the normal gland, in a group of mixed tumors, and in carcinoma of the parotid gland. In all cases in the neoplastic group the clinical, roentgenographic, operative, and histological findings have been correlated.

The clinical material upon which this study is based consists of over 200 lipiodol injections of the parotid duct system in 125 individual cases. The various diseases studied by this method are listed in Table I.

HISTORICAL

The first roentgen demonstration of the parotid duct system was made by Charpy, who published a "radiogram" of an isolated parotid gland injected with mercury in Poirier and Charpy's *Traite d'anatomie* (21) in 1904. The first practical application of this procedure in a living individual according to Berraud was made by Arcelin. Berraud states that Arcelin in 1913 published the report of a case of a calculus in Wharton's canal which was injected with a bismuth solution prior to radiography. For about 13 years following this report we have been unable to find any mention of this procedure in the literature.

From the Head and Neck Department, Service of Dr. Hayes E. Martin, Memorial Hospital.

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In April, 1925, Carlsten injected a parotid gland with lipiodol and reported the procedure in 1926. Barsony reported a case in December, 1925, into which he injected 20 per cent potassium iodide to demonstrate a marked degree of dilation of Steno's duct. Barsony found no reference in the literature to a similar demonstration while Carlsten stated in his article that Barsony was reporting a similar case. Uslenghi, in Buenos Aires, described the procedure in July, 1925, and believed it to be original with him. Jacobovici, Poplitz, and Albu (13) in 1926 described the use of sialography in 3 cases, demonstrating respectively a salivary calculus, a tumor of the parotid proved at operation, and a tumor of the submaxillary gland. Keith in 1928 reported the use of the procedure in 1 case of parotitis. In 1930, Rocchi published an excellent article in which he reported the results of a study to determine the best radiopaque medium for the injection and the amount giving the best roentgen visualization. Likewise he reported the clinical use of this procedure in a wide variety of cases, including 3 unproved mixed parotid tumors. Since his report there have been numerous contributions correlating the roentgen and clinical findings in various conditions affecting the salivary glands. A comprehensive review on the clinical uses of sialography was published by Feuz (9) in 1935 and 1936.

TABLE I.—DISEASES OF THE PAROTID GLAND
STUDIED BY SIALOGRAPHY

	No. of cases
Normal parotids	23
Non-neoplastic diseases*	26
Neoplastic diseases	
Benign neoplasms (cysts, lipomas, also including tuberculous adenitis in this group)	7
Adenocystoma lymphomatosum of Warthin	1
Mixed tumors	40
Primary carcinoma of parotid	21
Metastatic carcinoma to parotid region	2
Lymphoma	1
Intraoral carcinoma	4
Total cases	125

*This group of non neoplastic disease of the parotid gland is discussed elsewhere (5).

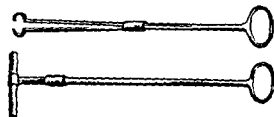


FIG. 8. Author's common duct tractor guide. Suitable sized tube introduced through small opening in common duct by grasping tube at the end and then regrasping at a suitable position for traction.

SECONDARY HEMORRHAGE

Serious secondary hemorrhage from the sloughing stump of a cystic artery that occurs several days after operation in advanced inflammatory, semi-gangrenous cases in which more or less gauze packing has been left *in situ* may prove a serious complication and tax the ingenuity and judgment of the surgeon to the utmost. We have known it to occur after the unskillful removal of a gauze pack by an interne. Any such pack should be removed by the surgeon who placed it at the operation.

When packing is indicated we have adopted the 1 inch gauze strip placed in accordion fashion with a rubber sleeve between it and the viscera, as it permits of comparatively painless gradual

removal, the trick being to grasp the end of the strip with a straight artery clamp and rotate it thus winding the strip into a rope for a short distance each day. A few drops of peroxide of hydrogen left on the next layer serves to loosen it appreciably between dressings. Abrupt, rapid removal of gall bladder packs has been known to produce severe and even fatal shock as well as annoying and sometimes serious secondary hemorrhage. By the use of the above method the entire pack may be removed without exerting any direct pull.

DIRECT POSTOPERATIVE HEMORRHAGE FROM CYSTIC ARTERY STUMP

When, in the hours following a cholecystectomy the patient presents unmistakable signs of a progressively severe internal hemorrhage—which cannot be accounted for otherwise—the chances are that it is due to release of the cystic artery ligature or to an accessory cystic artery which was not ligated. It may be imperative after blood transfusion, to re-open the wound, search for and control the bleeding stump—a most miserable experience for the surgeon and one in which he may injure the common or hepatic ducts. To avoid this pitfall the surgeon should be absolutely sure that in every cholecystectomy the cystic and other anomalous cystic arteries are securely ligated.

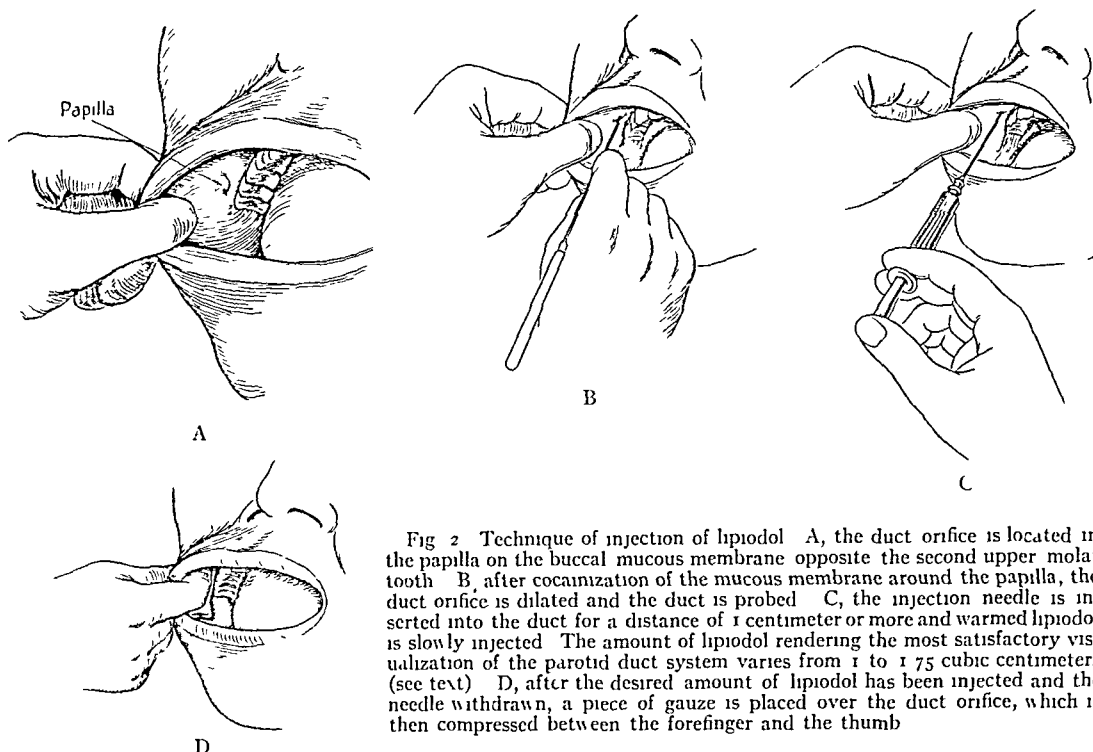


Fig 2 Technique of injection of lipiodol A, the duct orifice is located in the papilla on the buccal mucous membrane opposite the second upper molar tooth B, after cocainization of the mucous membrane around the papilla, the duct orifice is dilated and the duct is probed C, the injection needle is inserted into the duct for a distance of 1 centimeter or more and warmed lipiodol is slowly injected The amount of lipiodol rendering the most satisfactory visualization of the parotid duct system varies from 1 to 1.75 cubic centimeters (see text) D, after the desired amount of lipiodol has been injected and the needle withdrawn, a piece of gauze is placed over the duct orifice, which is then compressed between the forefinger and the thumb

clinic that this procedure has been considered too difficult and too time-consuming to permit its use in everyday practice. On the contrary, we have found the technique to be quite simple and that the entire procedure of injection rarely consumes more than 5 to 8 minutes. A difficulty, only rarely encountered, however, is the identification of the orifice of the duct, after which the subsequent procedures are easily and quickly performed.

The paraphernalia needed for the injection of lipiodol are a 2 cubic centimeter tuberculin syringe and a 20 gauge 3 inch needle, the tip of which has been made blunt. Various special cannulas have been devised and used, for which, we believe, there is little indication. A lachrymal dilator or tapered probe and an ordinary blunt tip fine wire probe complete the necessary apparatus. The fluidity of the lipiodol (40 per cent iodine) may be increased by immersing it in hot water immediately before using.

For the injection we prefer to have the patient in a sitting position as it is more convenient to both the patient and the operator. When the duct is easily located and readily probed, the injection can be performed satisfactorily with the patient lying on his back on the x-ray table. As a source

of good illumination we use an electrically illuminated head mirror.

The mucous membranes surrounding the orifice are anesthetized by the topical application of a 10 per cent solution of cocaine. We have found surface anesthesia of only slight advantage and have not noted any unusual tendency to drying up the salivary secretions as has been suggested by Payne (18).

The location of the duct orifice is in the papilla of the buccal mucous membrane adjacent to the second upper molar tooth (Fig 2, A). If the orifice is not visible, gentle massage over the gland and duct will express saliva and thereby disclose its location. Drying the papilla with a cotton applicator or by spraying with air will aid in identifying the point from which the drop of saliva was ejected or expressed. When nothing can be expressed from the gland, the flow of saliva may be stimulated by sucking a lemon or some similar substance. Recently we have seen a patient in whom we were able to identify the duct orifice only after 30 minutes of chewing gum and sucking on a piece of lemon. This, of course, represents a rare type of case and not often does this difficulty occur.

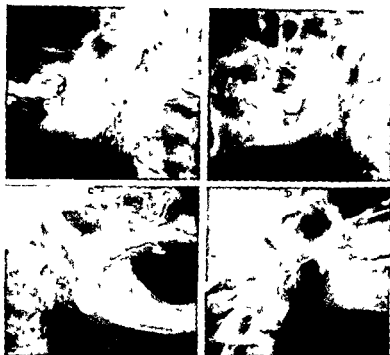


FIG. 1. Lateral projection of 4 normal salivary glands demonstrating variations in size of the duct system as visualized roentgenographically after lipiodol injection. Note the variation in position of the accessory lobule and in A and B the occurrence of several lobules.

ANATOMY OF THE PAROTID GLAND

The *parotid gland* a racemose gland of the serous type is the largest of the salivary glands. In anatomical texts its position is described as below and in front of the ear in the retromandibular fossa, and extending from the zygomatic arch above to the angle of the mandible below. The gland consists of a superficial portion, a deep processus retromandibularis, and one or more accessory lobules.

Roentgen visualization has demonstrated that the gland frequently extends beyond the mastoid tip below the mandible, and sometimes even to the submaxillary region. Simon has reported a case in which there was a communication between the parotid and the submaxillary gland with consequent absence of Stensen's duct.

The processus retromandibularis is best demonstrated on postero-anterior roentgenograms (Fig. 4). It is worthy of mention that in these views this portion of the gland may extend so far medially toward the midline as to be partially superimposed on the lateral margin of the vertebral shadow, and in such cases it may lie in close

proximity to the pharyngeal wall and the tonsil. This as we shall later discuss is important to remember when dealing with mixed tumors in this region. Seydell has reported a case in which parotid gland tissue was removed from the tonsillar bed at tonsillectomy.

The *accessory gland* is located anterior to the main mass and above the duct. In about 50 per cent of the cases there are 2 or more accessory glands present (Fig. 1, A and B).

The *duct system* consists of numerous branches emptying into a common duct, Stensen's or Stenos's in the anterior part of the gland. The latter runs transversely forward, crosses the masseter, and at the anterior border of this muscle turns inward nearly at a right angle. It then passes obliquely forward between the buccinator muscle and the mucous membrane of the mouth to open in a small papilla on the oral surface of the cheek opposite the second molar tooth.

TECHNIQUE OF INJECTION

We have gained the impression from opinions expressed and queries made by visitors to our



Fig 4 Same study as in Figure 3 These postero-anterior views demonstrate how far mesially the processus

retromandibularis may extend In this position it lies in close proximity to the lateral pharyngeal wall and tonsil

6 To determine whether a tumor in the parotid region is an encapsulated growth in the gland substance, a tumor infiltrating the duct system and gland, or a mass extrinsic to the gland and ducts proper

7 To determine the proximity of the retro-mandibular process of the gland to a mixed salivary tumor in the tonsillar region

8 To aid in the planning of an operative procedure in the parotid region

We believe that sialography is generally contraindicated in acute parotitis since it gives no additional information and may cause the patient more pain by distending the ducts and alveoli of the gland Csillag and Czunft likewise deem this procedure contraindicated in acute infections On the other hand, in chronic infections, the lipiodol may have a definite therapeutic effect

In epidemic parotitis (mumps) we see no necessity for a sialographic study Hobbs, Sneierson, and Faust performed sialographic studies in this condition and demonstrated typical inflammatory changes Also in postoperative parotitis there is no indication for the procedure

We have had no complications in any of our injections Occasionally the duct orifice may be

slightly traumatized by the dilatation or probing In 1 case of a chronically infected cyst, an acute parotitis, which necessitated incision and drainage, resulted 5 days after the lipiodol injection

If a sialogram is performed either immediately or several days after a biopsy, a fistulous tract is demonstrated on the sialogram (Figs 7, D, and 8, C) which obscures detail and may simulate changes on the basis of which an erroneous diagnosis may be made Therefore, if both procedures are to be performed on the same case, the sialographic study should be completed first

STUDY OF LIPIODOL FILLING AND EMPTYING

In the literature on this subject varying opinions are found regarding the amount of lipiodol necessary for the most satisfactory visualization of the duct system in the average patient Amounts varying from 0.50 to 6 cubic centimeters have been used (Table III) In our earlier

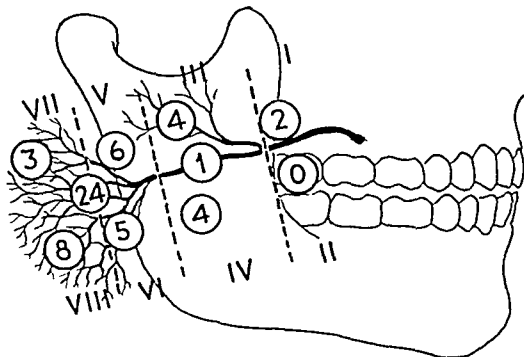


Fig 5 Diagram, based on a study of 57 cases, showing the frequency and position of mixed tumors in relation to the parotid duct system The numbers in the circles indicate the frequency of occurrence in the respective positions The roman numerals represent arbitrary divisions of the duct system

TABLE III — AMOUNTS OF LIPIODOL USED BY VARIOUS INVESTIGATORS

	Cubic centimeters
Carlsten (1 case in 1925)	5.0
Jacobovici, Poptitza, Albu (1926)	4.0 (20 percent iodopine)
Rocchi (1930)	1.5 to 2.0
Barraud (1931)	2.0 to 4.0
Payne (1931)	0.5 to 1.0
Feuz (1932)	2.0 to 4.0
Hobbs, Sneierson and Faust (1932)	1.0 to 1.5
Jacobovici and Jianu (1933)	4.0 to 6.0
Simon (1934)	2.0 to 5.0
Grasso (1934)	1.5 to 2.0
Hare (1935)	0.5 to 1.0
Kimm, Spies, and Wolfe (1935)	1.0 to 1.5
Blady and Hocker (1937)	1.0 to 1.75

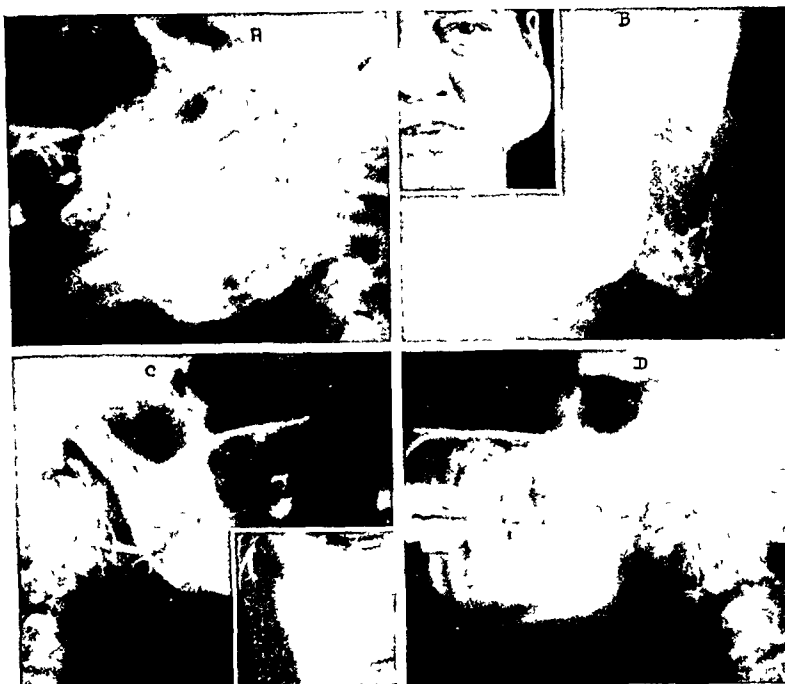


Fig 7 Mixed salivary tumors of the parotid gland A and B, the entire duct system is distorted and displaced by the large, somewhat irregular growth The gland surrounds the periphery of the tumor Steno's duct is displaced and buckled by the growth C, small mixed tumor arising in the accessory gland Both the accessory duct and Steno's duct are displaced caudad and in addition the duct is obstructed, resulting in a distal dilatation of the entire duct system Note posterior displacement and buckling of the duct D, large mixed tumor situated in the anterior and caudal portion of the gland, and displacing it backward and upward The puddling of lipiodol in the tumor is due to a fistulous tract following an incisional biopsy performed several days prior to the lipiodol injection Such puddling, when superimposed over a duct, may obscure detail or may be confused with localized diffusion of lipiodol as seen in cases of carcinoma Aspiration biopsy causes similar traumatic changes In any case, where the two procedures are to be performed, sialography should be completed before doing the biopsy

the onset of pain (Table II), *we have arrived at an arbitrary rule requiring the total injection of 3 to 5 times as much lipiodol as the initial amount producing discomfort and pain* This permits individual variation and still provides that a sufficient amount is injected In some instances we have found it desirable to perform 2 injections of the gland, one for a study of the duct system and the other to visualize the gland substance by over-injection

Normally the lipiodol empties from the gland in 1 to 3 days, although in cases when 2 to 3 cubic centimeters are injected, or when repeated injections are made, a residue can still be demonstrated from 5 to 15 days later In cases of obstruction, stricture, or abnormal dilatation, as in infections,

lipiodol remains in the gland substance for an even longer period of time

Recently we have learned that Rocchi in 1930 performed a similar study on a gland removed from a cadaver He made 4 successive injections of 0.5, 1, 1.5, and 2 cubic centimeters of lipiodol into this isolated gland and obtained roentgenograms following each injection He concluded that the best roentgen visibility of the gland was obtained when 1.5 to 2 cubic centimeters of lipiodol was injected Although we were unaware of this study our results are in complete accord with Rocchi's The reason we give 1.75 cubic centimeters as the maximum amount is that quite frequently we have observed diffusion of the lipiodol into the gland substance when 2 cubic centimeters

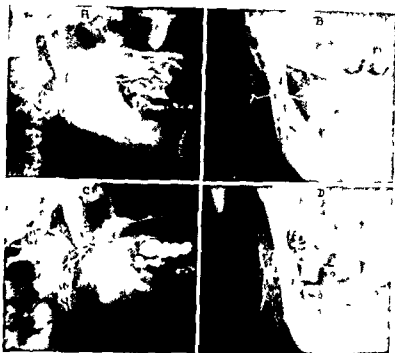


FIG. 6. A and B salivary tumors of the parotid gland. A and B these roentgen grams demonstrate the distortion and displacement of the duct system by a tumor located in the tail of the gland and lying inferior or mesial to the gland itself. C and D these roentgenograms demonstrate the duct displacement produced by a tumor lying superior or lateral to the gland. In comparison to A and B, very little distortion of the duct system is observed here. With this preoperative information the surgeon has a better understanding of the difficulties he may encounter in the case shown in A and B. In C and D, on the other hand, the removal would be a relatively simple procedure.

injections little attention was paid to the amount injected and frequently certain peculiar roentgen appearances of the gland were noted which at the time were not clearly understood and frequently were incorrectly interpreted. In order to determine the amount of lipiodol necessary for a satisfactory injection and the reasons for these peculiar roentgen appearances we made a roentgen study of the normal gland in 10 individuals by injecting different amounts (1, 2 and 3 cubic centimeters) of lipiodol in the same individual at intervals of 2 to 7 days.

Roentgenographic study. One cubic centimeter of lipiodol gives an excellent visualization of the entire duct system and demonstrates the finer ramifications in all portions of the gland. With less than 1 cubic centimeter there is incomplete filling of the duct system. With 2 cubic centimeters of lipiodol beginning diffusion into the gland is commonly observed and occasionally

there is also some enlargement in the size of Steno's duct. The injection of 3 cubic centimeters causes diffusion of the oil throughout the gland substance, obscuring the definition of the secondary ducts and their finer ramifications (Fig. 3). The roentgen picture of this wide diffusion can best be compared with the appearance of a tree in late spring or summer. After the injection of 1 cubic centimeter, on the other hand, the facsimile of the x-ray appearance of the duct system is that of a bare tree in winter. In the German literature the roentgen picture of diffusion of the lipiodol has been termed *Wolkenartiger Schatten* (cloud like shadow) and *Apfelblueten* (apple blossoms).

The amount of lipiodol necessary for a satisfactory injection in the average case, as determined from this study, we believe is from 1 to 1.75 cubic centimeters. By correlating the amount of lipiodol necessary for a good roentgenographic study and

was injected. As this is an undesirable effect, because it obscures duct detail, we believe that the maximum amount of lipiodol injected should not exceed 1.50 to 1.75 cubic centimeters

MIXED TUMORS

This roentgenographic study of mixed tumors is based on an analysis of sialograms in 40 patients with proved mixed tumors in the parotid. In all of these the radiographic findings were correlated with the clinical findings, the pre-operative aspiration biopsy, the operative findings, and by subsequent histological study of the excised tumor.

Location (Fig. 5). These tumors may be found in any region of the cheek, submandibular portion of the neck, retromandibular space, or even in the external auditory canal which lies in close proximity to the gland. The most common locations are the retromandibular and the pre-, sub-, and postauricular areas. The presence of mixed salivary gland tumors in the anterior portion of the cheek near Steno's orifice is uncommon, in our series 2 such cases are recorded. In rare instances a tumor arising in the retromandibular region may extend medially instead of laterally and present intra-orally either in the region of the tonsil or through the buccal mucous membrane between the mandible and the superior maxilla, a possibility which should be remembered when dealing with growths in this region.

A study of the sialograms has revealed the following roentgen findings in mixed tumors of the parotid.

Filling defect. The encapsulated mixed tumor of the parotid gland is usually readily visualized on the sialogram. The most consistent x-ray finding is the filling defect outlined by the displaced ducts surrounding the tumor. The duct system in these cases presents no irregularities or destructive changes. Each duct is visualized in its entirety, although its shape and configuration may vary with the degree of its displacement. If the neoplasm is located near the periphery a small defect may be noted as only the most terminal arborescences become displaced. If the position is central, the resulting defect depends on whether the mass is medial or lateral to the gland. If the tumor lies mesial to the gland, the latter is displaced outward and part of the growth may protrude through its center (Fig. 6, A and B). When the tumor is located lateral or external to the gland only portions of the gland around the periphery of the tumor are displaced (Fig. 6, C and D). In addition to displacement of adjacent gland substance, the duct itself can be displaced in any direction by a tumor located in close prox-

imity. In 1 of our cases the tumor compressed the duct without displacing the gland, and the sialogram demonstrated not only compression of the duct but likewise a resulting distal dilatation due to retention of secretions (Fig. 7, C).

Buckling of the duct is another interesting finding. We have noted its occurrence in the anterior half of the duct as well as in its distal portion. This finding, however, is not diagnostic of mixed tumors as it may occur in any condition in which a mass pushes the duct backward or in which the gland is displaced forward, buckling may be observed, therefore, in inflammatory conditions involving adjacent structures as well as with neoplasms. The buckling is produced by pushing the duct either ventrad or dorsad or by displacing the gland forward, thus crowding the distal half of the duct up on itself toward the gland (Figs. 6, C and D, 7 A, B, and C).

Pressure erosion or atrophy of the mandible, either along the posterior or lateral aspects, has been observed in a number of cases in which large tumors have been present for long periods.

Sialograms simulating those produced by mixed tumors may be seen with benign growths, such as lipomas, branchiogenic cysts, cysts, adenocystoma lymphomatosum of Warthin, tuberculous adenitis, and also with small metastatic nodes.

The occurrence of small mixed tumors in the region of the accessory gland is not uncommon and the changes observed are similar to, although sometimes not quite so marked as, those just described (Fig. 7, C).

The important practical application of sialography in mixed tumors lies not in the demonstration of the presence of such a mass but, as Lange has stated, in the fact that "today the operative plan can be determined before operation more accurately than has been possible up to date." The size of the tumor and its position are clinical observations but the determination of its position in relation to the gland and main duct, and as to whether it lies underneath or over the gland, is reserved to this procedure. Hence, this additional visual information will aid in planning the most suitable approach, thereby avoiding unnecessary difficulty of exposure and possible injury to the nerve, gland, and ducts.

CANCER

Twenty-four of the 76 tumors studied in this series were carcinomas, 21 of these were primary in the parotid gland.

During the analysis of our sialographic studies we were impressed by a rather definite roentgen picture which demonstrated, not only the presence



Fig 8 Carcinoma of the parotid gland. A M S aged 39. Epidermoid carcinoma. Note (1) failure to visualize the duct system; only the main duct is seen; (2) abrupt stoppage of lipiodol in the main duct; and (3) filling defects in the gland substance. B E H aged 57. Papillary and solid adenocarcinoma. Note (1) filling defect and displacement of duct system; (2) incomplete filling and failure to visualize the complete duct system in the upper duct branch; and (3) puddling, or irregular localized diffusion of lipiodol into the tumor. Preoperative x-ray diagnosis was carcinoma. C V F aged 49. Incisional biopsy reported as intra epithelial epidermoid carcinoma. Note (1) incomplete duct filling; (2) abrupt stoppage of lipiodol in ducts; and (3) irregular filling defects in gland. Note fistula following biopsy. D N S aged 60. Adenocarcinoma. Findings similar to those seen in A and C.



Fig 9 Carcinoma of the parotid gland. A T B aged 68. Carcinoma. Note (1) poor filling of entire duct system; (2) irregular small defects near periphery of gland; and (3) irregular puddling of lipiodol in the peripheral portion of the gland. B W B aged 73. Adenocarcinoma. Findings similar to those described in A.

The roentgenograms of the mandible demonstrated a metastatic defect in the angle of the mandible and the sialogram appeared entirely normal. On this evidence a roentgen diagnosis of metastatic carcinoma was made, which was confirmed 6 months later by a discovery of a primary renal carcinoma.

SUMMARY AND CONCLUSIONS

1 The appearance of the normal parotid gland and its variations as determined by roentgen visualization are described

2. The technique, indications, and contraindications are discussed. The technique is a comparatively simple procedure for which no special paraphernalia are required.

3. Experimental studies on the normal gland have demonstrated the fact that lipiodol injections of not less than 1 cubic centimeter and not more than 1.75 cubic centimeters render the most satisfactory roentgen visualization of the parotid gland. Because of variability in the size and capacity of the duct system, an arbitrary rule has been formulated which permits variation in the amount of lipiodol used and requires that 3 to 5 times as much lipiodol be injected as the initial amount producing discomfort or pain.

4. In the normal, the lipiodol empties from the gland in 1 to 3 days. In abnormal conditions it may remain in the gland for periods longer than 2 weeks.

5. This roentgen study is based on an analysis of various neoplastic conditions in 76 cases, in all of which the clinical, the operative, the histological, and the roentgenographic findings have been correlated.

6. The use of this procedure in mixed tumors of the parotid is discussed. The roentgen findings, depending on the various locations of the tumor, are presented. Sialography has made it possible to determine the operative plan before operation more accurately than has been heretofore possible.

7. The roentgenographic changes caused by infiltration, as observed in 62 per cent of the cases in this series, are described. We believe that when this picture of infiltration is observed it is diagnostic of carcinoma.

8. Illustrations of the various points discussed are presented.

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of a filling defect, but also absence of duct markings, irregularity in the outline of the ducts, and peculiar irregular filling defects in the gland substance itself. On correlating the clinical, roentgenological, and pathological findings in these cases we noted that this roentgen picture was consistent with the histological finding of cancer. In 1931 Pyrah and Allison first noted the fact that

'the gland may be largely destroyed and there may be a considerable filling defect on the sialogram'

Barsky and Silberman in 1932 stated that the absence of duct markings in the region of the tumor indicated a "malignant character of tumor," while Csillag and Czunst in 1934 more accurately described the changes produced by infiltrating tumors. They stated that cancer of the parotid gland 'can be recognized by the destruction of the finer ramifications of the excretory ducts and by filling defect due to the destruction of the glandular substance.' Kimm, Spies and Wolfe in 1935 considered non filling and irregularity of the ducts' as evidence of carcinomatous invasion. Later in the same year Hare reported similar findings.

In all these reports the roentgen changes are merely mentioned or described in the body of a case report. We believe that their evaluation and importance as a diagnostic criterion of cancer of the parotid gland has not been fully appreciated.

TABLE IV — CORRELATION OF INFILTRATION AS SHOWN ON SIALOGRAMS WITH HISTOLOGICAL TYPE OF TUMOR*

Type lesion (histology)	No of cases	Sialograms showing infiltration	Percent
Adenocarcinoma	14	8	
Epidermoid carcinoma	4	4	
Squamous carcinoma	3	1	
Myxochondro carcinoma	1	0	63
Metastatic cancer	2	1	
Lymphoma	1	0	
Total	24	14	58

*In 6 per cent of primary parotid gland carcinoma the roentgen changes caused by infiltration were observed.

The occurrence of these very definite roentgen changes in 62 per cent of the carcinomas primary in the parotid is of sufficient import to warrant describing the findings in more detail. We believe that when this picture of infiltration is observed it is diagnostic of cancer. The reason for failure to demonstrate these findings in a greater percentage of cases is that the carcinoma arising in a minute focus of the encapsulated mixed tumor is still localized and has not yet infiltrated the gland substance. Even aspiration biopsy in such cases may not be diagnostic since the aspirating needle may not strike the cancerous area. Only after

removal and examination of the entire specimen is the cancer located (Fig 8).

The x ray findings or changes are to some degree dependent on the location of the lesion and, therefore fall into 2 general groups.

In the first group, in which the growth is centrally located within the gland substance itself the following changes are observed: (1) Irregular defects in the gland substance, (2) Distortion of the normal duct alignment, (3) Incomplete filling and irregularity of and failure to visualize the duct system and (4) Puddling or diffusion of lipiodol in the tumor area, due to destruction of a duct or ducts with escape of the lipiodol into the adjacent tissues (Fig 9).

In the second group the findings are those observed with growths situated near the periphery or in the tail of the gland. The sialogram in these cases demonstrates the following changes: (1) Complete filling of the portion of the gland and ducts distal to the lesion, unless the latter is located near Steno's duct, in which case the duct system in the gland is not visualized, due to compression of Steno's duct or infiltration and blocking of the duct by tumor, (2) Only slight distortion of normal duct alignment, (3) Irregularity and defects in the portion of the gland involved by the growth, and (4) Irregular puddling of lipiodol in the portion of the gland that is infiltrated.

EVALUATION OF STUDY

Encapsulated growths, such as mixed tumors as has been shown, distort and produce a displacement of the gland which results in a definitely outlined filling defect but do not produce irregular defects and deformity of the ducts and gland substance. In the entire neoplastic group we did not find such infiltrative changes in any of the mixed tumor cases not exhibiting carcinomatous changes. In obstructive and in inflammatory conditions puddling and sometimes even slight irregularity of the ducts is seen but these changes are not associated with filling defects as produced by tumors. The roentgen findings in non neoplastic conditions are described elsewhere (5).

As is commonly known metastatic cancer may involve the parotid gland. More frequently, however it involves adjacent structures and then may extend to the gland. In such cases the invasion of the gland can be demonstrated by a sialogram and frequently primary and metastatic growths can be thus differentiated.

In one of the cases the clinical findings were typical of a parotid tumor and the aspiration and later incisional biopsy were reported as cancer with malignant mixed and squamous features.

The roentgenograms of the mandible demonstrated a metastatic defect in the angle of the mandible and the sialogram appeared entirely normal. On this evidence a roentgen diagnosis of metastatic carcinoma was made, which was confirmed 6 months later by a discovery of a primary renal carcinoma.

SUMMARY AND CONCLUSIONS

1 The appearance of the normal parotid gland and its variations as determined by roentgen visualization are described.

2 The technique, indications, and contraindications are discussed. The technique is a comparatively simple procedure for which no special paraphernalia are required.

3 Experimental studies on the normal gland have demonstrated the fact that lipiodol injections of not less than 1 cubic centimeter and not more than 1.75 cubic centimeters render the most satisfactory roentgen visualization of the parotid gland. Because of variability in the size and capacity of the duct system, an arbitrary rule has been formulated which permits variation in the amount of lipiodol used and requires that 3 to 5 times as much lipiodol be injected as the initial amount producing discomfort or pain.

4 In the normal, the lipiodol empties from the gland in 1 to 3 days. In abnormal conditions it may remain in the gland for periods longer than 2 weeks.

5 This roentgen study is based on an analysis of various neoplastic conditions in 76 cases, in all of which the clinical, the operative, the histological, and the roentgenographic findings have been correlated.

6 The use of this procedure in mixed tumors of the parotid is discussed. The roentgen findings, depending on the various locations of the tumor, are presented. Sialography has made it possible to determine the operative plan before operation more accurately than has been heretofore possible.

7 The roentgenographic changes caused by infiltration, as observed in 62 per cent of the cases in this series, are described. We believe that when this picture of infiltration is observed it is diagnostic of carcinoma.

8 Illustrations of the various points discussed are presented.

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of a filling defect, but also absence of duct markings irregularly in the outline of the ducts, and peculiar irregular filling defects in the gland substance itself. On correlating the clinical roentgenological, and pathological findings in these cases we noted that this roentgen picture was consistent with the histological finding of cancer. In 1931 Pyrah and Allison first noted the fact that

the gland may be largely destroyed and there may be a considerable filling defect on the sialogram.

Barsky and Silberman in 1932 stated that the absence of duct markings in the region of the tumor indicated a 'malignant character of tumor,' while Cullag and Czunft in 1934 more accurately described the changes produced by infiltrating tumors. They stated that cancer of the parotid gland 'can be recognized by the destruction of the finer ramifications of the excretory ducts and by filling defect due to the destruction of the glandular substance.' Limm, Spies and Wolfe in 1935 considered non filling and irregularity of the ducts' as evidence of carcinomatous invasion. Later in the same year Hare reported similar findings.

In all these reports the roentgen changes are merely mentioned or described in the body of a case report. We believe that their evaluation and importance as a diagnostic criterion of cancer of the parotid gland has not been fully appreciated.

TABLE IV—CORRELATION OF INFILTRATION AS SHOWN ON SIALOGRAMS WITH HISTOLOGICAL TYPE OF TUMOR*

Type of lesion (all sialograms)	No. of cases	Sialogram showing infiltration	Percentage
Adenocarcinoma	14	8	
Epidermoid carcinoma	4	4	
Squamous carcinoma	2	1	
Myxochondroid carcinoma	1	0	62
Metastatic cancer	2	1	
Lymphoma	1	0	
Total	24	14	58

*In 62 per cent of primary parotid gland carcinomas the roentgen change caused by infiltration was observed.

The occurrence of these very definite roentgen changes in 62 per cent of the carcinomas primary in the parotid is of sufficient import to warrant describing the findings in more detail. We believe that when this picture of infiltration is observed it is diagnostic of cancer. The reason for failure to demonstrate these findings in a greater percentage of cases is that the carcinoma arising in a minute focus of the encapsulated mixed tumor is still localized and has not yet infiltrated the gland substance. Even aspiration biopsy in such cases may not be diagnostic since the aspirating needle may not strike the cancerous area. Only after

removal and examination of the entire specimen is the cancer located (Fig. 8).

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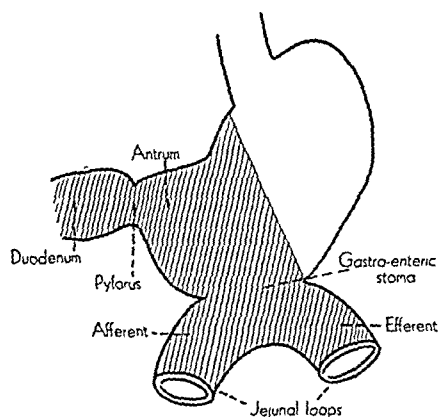


Fig 1 Anatomical areas represented in resected specimens

Often the apparent scarring and deformity observed with the tissues *in situ* were not evident in the resected specimens. The induration and adhesion of the posterior duodenal wall so often noted in primary cases were usually found to be dependent upon *periduodenal* rather than *intraduodenal* changes in these secondary ones. These comparatively minor *objective* evidences of healing cast some light upon the nature of the healing process induced by gastro-enterostomy. It is well known both from clinical and radiological evidence that peptic ulceration tends to undergo a regular cycle of healing and recrudescence. In patients subjected to operation after prolonged medical therapy, it is not unusual to find a disappearance of the ulcer with minimal or no evidence of scarring. In several such patients in whom the primary operation was limited merely to exploration, because of the paucity of findings, subsequent laparotomy because of recurrence of symptoms revealed large active duodenal ulcers. Such healing of an ulcer with the apparent restitution to normal of the duodenum may, therefore, indicate a condition of *latency* rather than that of *cure*. The permanent subsidence of ulcer activity is perhaps only objectively manifested by the scarring and stricture at the ulcer site such as is seen with the so called "spent" or "burnt-out" ulcer which results in a pyloric stenosis. This type of lesion usually does well after gastro-enterostomy and is rarely followed by a gastrojejunal ulcer. However, it is evident from the resected specimens as described above, that this type of healing is not induced by gastro-enterostomy in the ordinary active duodenal ulcer.

The nature of the healing induced in duodenal ulcers by gastro-enterostomy is suggested by a

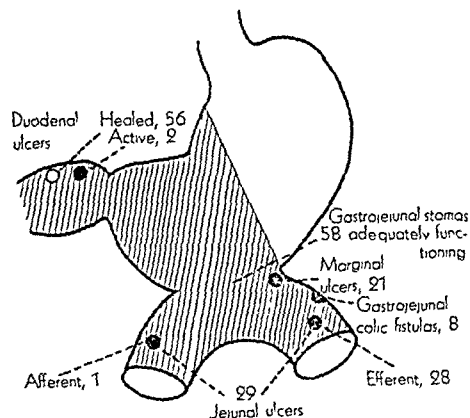


Fig 2 Analysis of 58 specimens revealing gastrojejunal ulcers

consideration of the following group of 6 cases (Fig 4). In these patients a gastro-enterostomy had originally been performed for the cure of an active duodenal ulcer. After varying periods of time these patients were subjected to re-operation because of complicating gastrojejunal ulcerations. At that time, it was noted that all evidences of active duodenal ulceration had disappeared, the stomas were therefore disconnected and the normal continuity of the gastro-intestinal tract re-established. The recurrence of severe ulcer symptoms led to a third operation when it was found that large penetrating duodenal ulcers had reappeared. This series of cases which, in retrospect, has almost the lucidity of a planned experiment, would tend to indicate that the healing of a duodenal ulcer following gastro-enterostomy is not dependent upon any curative effect on its basic cause. It would seem that in these cases gastro-enterostomy induced a condition of latency similar to that encountered in the phase of spontaneous remission which lasted only as long as the gastro-enterostomy continued to function. It would, furthermore, seem that, when the ulcer tendency is still active as manifested by the presence of an active ulcer in the stoma, disconnection may result in the reactivation of what appears to be a healed duodenal ulcer. If the ulcer tendency is still in the active phase, disconnection or new anastomoses may simply lead to changes of localization of the ulcer. This is manifested by 4 other cases. In 1 of these, a fourth operation, a new gastro-enterostomy was added to the 3 outlined above. The duodenal ulcer again disappeared and a new anastomotic ulcer developed. In the 3 other cases, new gastro-enterostomies had been added without disconnecting the old ones which were

FAILURES FOLLOWING GASTRO-ENTEROSTOMY FOR GASTRODUODENAL ULCER

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THE status of gastro enterostomy has remained unsettled ever since partial gastrectomy was first advocated two decades ago as a preferable operation for the treatment of peptic ulcer. In 1923 Lewisohn in supporting this more radical view, claimed that gastro enterostomy was complicated by a prohibitive incidence of gastrojejunal ulcer of 34 per cent (18 per cent proved by operation). This contention precipitated a controversy concerning the frequency of that complication which has continued to date. Although this paper constitutes a study of a series of failures of gastro enterostomy it is not intended to be a controversial presentation. Its purpose is rather to consider impartially certain observations which we feel may contribute to a better understanding of the modus operandi of gastro enterostomy and the nature of its complications.

Partial gastrectomy when applied to cases which have been unsuccessfully treated by a previous gastro enterostomy permits a thorough study of the effects of the original operation. The potential ulcer bearing area of the stomach is not only surgically exposed but the first portion of the duodenum pylorus antrum gastro enteric stoma and as a rule the associated anastomotic jejunal loops become available as specimens for pathological study (Fig 1). This communication is based upon a review of 86 such resected specimens as well as upon a consideration of the clinical pathological and radiological features of these cases. As 23 of these patients had in addition been subjected to multiple previous conservative procedures in attempts to control post gastro enterostomy symptoms an opportunity was also afforded to study the effects of such measures on the complications of gastro enterostomy. These partial gastrectomies were performed on the gastro-intestinal ward service of Mount Sinai Hospital during the period from 1923 to 1936. Case of gastrojejunal ulcer treated in any other fashion than by gastric resection are not included in this study. The fact that 39 of the gastro enterostomies were originally done at Mount Sinai Hos-

pital and the 39 remaining at different institutions would suggest that this material presents a general rather than a particular experience with this operation. It also reflects the difficulty of following and satisfactorily determining the end results of these patients who are apt to migrate in seeking relief of their persistent symptoms.

In summarizing our observations on the resected specimens, it seemed best to group them according to the lesion which required re-operation and to discuss them in the light of the previous gastro enterostomy.

In 58 specimens revealing either an anastomotic or jejunal ulceration the original duodenal ulcer for which a gastro enterostomy has been performed was found to be healed in 56 and still active in only 2. In every such instance the stoma was adequate in size anastomotically well placed and functionally efficient (Fig 2).

In 11 specimens persistent active duodenal ulcerations were present, of which only 7 were associated with active gastrojejunal ulceration (Fig 3). These latter cases are the ones cited above. All the remaining 9 cases showed inadequacy of the stomas either because of stenosis inadequate size or malposition. A consideration of the above findings suggests the following inferences: (1) An efficient gastro enterostomy tends to cause the disappearance of an active duodenal ulcer. (2) Failure of a duodenal ulcer to heal after a gastro enterostomy is usually associated with a mechanically inefficient stoma. (3) While the mechanically efficient stoma tends to heal a duodenal ulcer, it also relatively favors the development of an anastomotic ulcer. (4) The co-existence of an active duodenal ulcer and of an active anastomotic ulcer is rare. We shall again refer to the significance of these findings in considering the mechanics of the healing induced by gastro enterostomy.

In most instances in which gastro enterostomy had apparently effected a disappearance of the previously active duodenal ulcer, the resected specimens revealed no other marked changes at the original ulcer site. Scarring at the site of the original ulcer was usually superficial strictures and obstructing stenoses were not encountered.

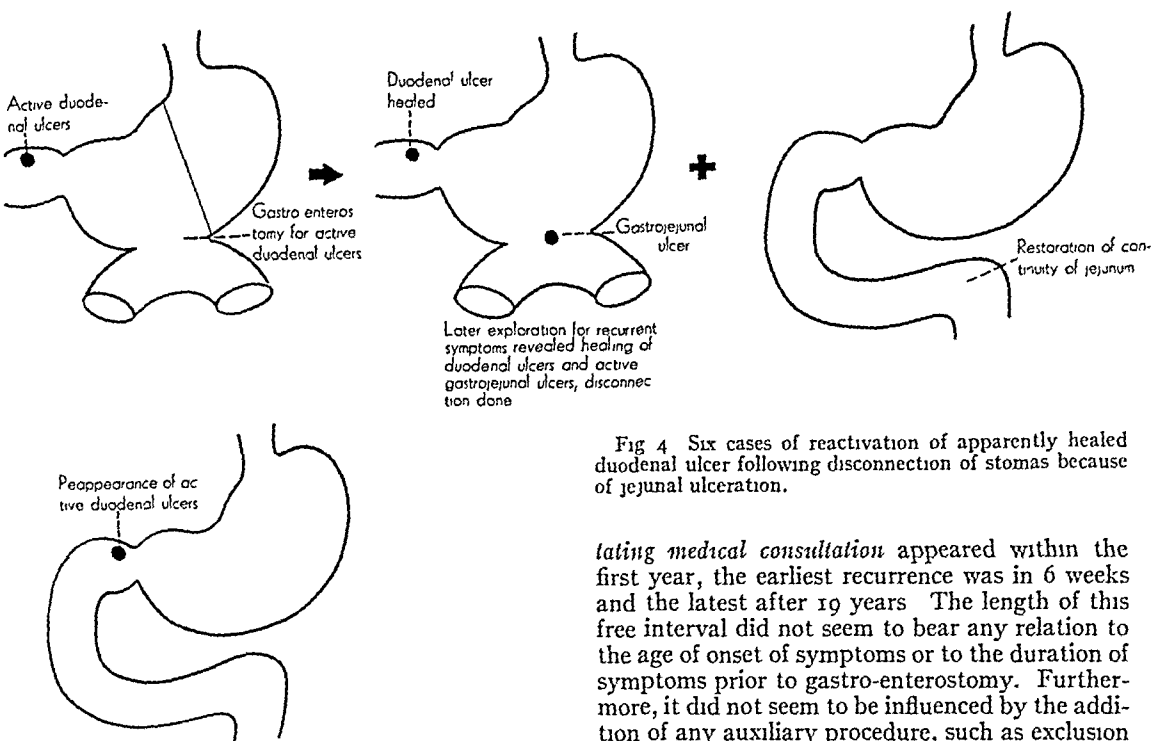


Fig 4 Six cases of reactivation of apparently healed duodenal ulcer following disconnection of stomas because of jejunal ulceration.

Occupation These cases represent the clinical material encountered in the wards of Mount Sinai Hospital. The great majority are Jewish, and are classified as factory workers and petty tradesmen with the minority as artisans and clerical workers. There were practically no unskilled laborers or agricultural workers. These patients as a rule are engaged in confining and arduous industries and do not enjoy hygienic and economic advantages. The great majority are heavy smokers.

While the incidence of chronic disease was not noteworthy, 3 patients suffering from thromboangitis obliterans, that of arrested pulmonary tuberculosis was rather high. There is perhaps no special importance to these features except that they represent the well recognized unfavorable factors of ulcer disease.

Onset and duration of symptoms In the great majority of cases the original ulcer symptoms commenced in the third or fourth decades and the recurrent complaints appeared in the fourth or fifth. These findings are of questionable significance as they represent the more common periods for the onset of ulcer symptoms.

A study of the symptom free interval after gastro-enterostomy is interesting. In 32, or 43 per cent of the cases, recurrent symptoms necessi-

lating medical consultation appeared within the first year, the earliest recurrence was in 6 weeks and the latest after 19 years. The length of this free interval did not seem to bear any relation to the age of onset of symptoms or to the duration of symptoms prior to gastro-enterostomy. Furthermore, it did not seem to be influenced by the addition of any auxiliary procedure, such as exclusion or excision of the primary ulcer. The recurrence of symptoms seemed to take place sooner in those cases of acute perforation supplemented by a gastro-enterostomy than in the general group. In 6 out of 8 such cases symptoms appeared within the first year. Some idea of the chronicity and intractability of the disease may be derived from the fact that 19 patients had suffered from symptoms for 10 to 15 years, 3 for 15 to 20 years, and 4 for over 20 years.

Symptoms The symptoms of the patients with recurrent ulceration could not be differentiated from those of primary chronic peptic ulcer. No particular clinical picture seemed to characterize the anastomotic ulcerations except when they were complicated by gastrojejunal colic fistulas. In about half the cases the complaints were of the ulcer type and were quite similar to those experienced prior to gastro-enterostomy. In general the symptoms seemed to be more severe and resistant to therapy. In many cases there were remissions. As they became shorter, the symptoms grew more severe until the continuous suffering forced these patients again to seek surgical relief.

Hemorrhage There were 13 patients in whom bleeding was a prominent symptom. They may be divided into a group in which hemorrhage was the only symptom, and into another in which the

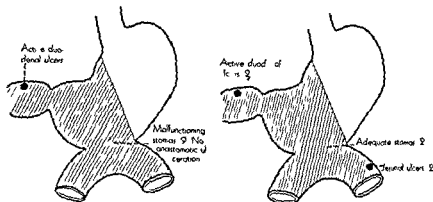


Fig 3 a Left Analysis of 11 specimens revealing active duodenal ulcers b Analysis of 11 specimens revealing active duodenal ulcers

functioning poorly and were apparently the seat of ulceration. At subsequent operation new anastomotic ulcers were found at the site of the 3 new functioning gastro-enterostomies.

It is instructive to compare the findings in cases in which gastro-enterostomy had failed to relieve the symptoms of lesser curvature gastric ulcers with those observed after its performance for duodenal ulcers. Six patients were re-operated upon because of the persistence of symptoms after gastro-enterostomy for lesser curvature ulcer (Fig 5). In 5 of these in the presence of a well placed and well functioning stoma a persistent gastric ulcer was found. In 1 instance the gastric ulcer had healed and an anastomotic ulcer was present.

In 6 other cases gastro-enterostomy had originally been performed for duodenal ulcer. Re-operation for recurrent symptoms revealed that new ulcers of the lesser curvature of the stomach had developed despite the fact that the stomas were well placed and adequately functioning (Fig 6). In only 1 out of the 12 cases of lesser curvature ulcer associated with adequate functioning gastro-enteric stomas was healing induced by a gastro-enterostomy. These findings contrast strikingly with those observed in the 58 cases cited above of gastrojejunal ulceration which followed gastro-enterostomy for active duodenal ulcers. It will be recalled that all the stomas were adequately functioning and in 56 the duodenal ulcer was found to be healed. It would therefore appear that lesions at the level or proximal to gastro-enterostomies are as a rule not as favorably affected as lesions distal to them. On the other hand, such stomas seem to be much less susceptible to the development of an anastomotic ulceration. This in turn would tend to emphasize the importance of the mechanical factor in gastro-enterostomy as op-

posed to the chemical, for the chemical effects should be just as great in gastric as in duodenal ulcer. It is difficult to say just how complete and constant the mechanical factor tends to be. It is known from fluoroscopic observations etc., that gastro-enterostomy does not completely divert the gastric contents through the gastro-enteric stoma. It must be remembered that such observations are usually made sometime after the establishment of the gastro-enterostomy, when there had been an opportunity to relieve the obstructive effects, e.g. spasm—edema resulting from the activity of a duodenal ulcer. It is not unlikely that the mechanical diverting of a gastro-enterostomy varies directly with the degree of such activity.

CLINICAL FEATURES

A review of the specimens revealed the causes for recurrent symptoms after gastro-enterostomy in this series of cases to be jejunal ulceration in 29 patients, marginal ulceration in 21, gastrojejunal colic fistulas in 8, new and recurrent gastric ulceration in 11 and recurrent duodenal ulceration in 17, in 6 of which the gastro-enterostomy had been previously disconnected. Because of the unusual opportunity of studying the anastomotic ulcerations which represent the most serious and important complications after gastro-enterostomy it is our intention to devote particular attention to clinical radiological and pathological features.

Sex. The incidence of recurrent or anastomotic ulcers in women appears to be even smaller than that seen with primary duodenal ulcer. Only 2 of the 78 patients were females. In these 2 the symptoms appeared relatively late in life and in 1 there had been a previous hysterectomy with a cessation of the menstrual function.

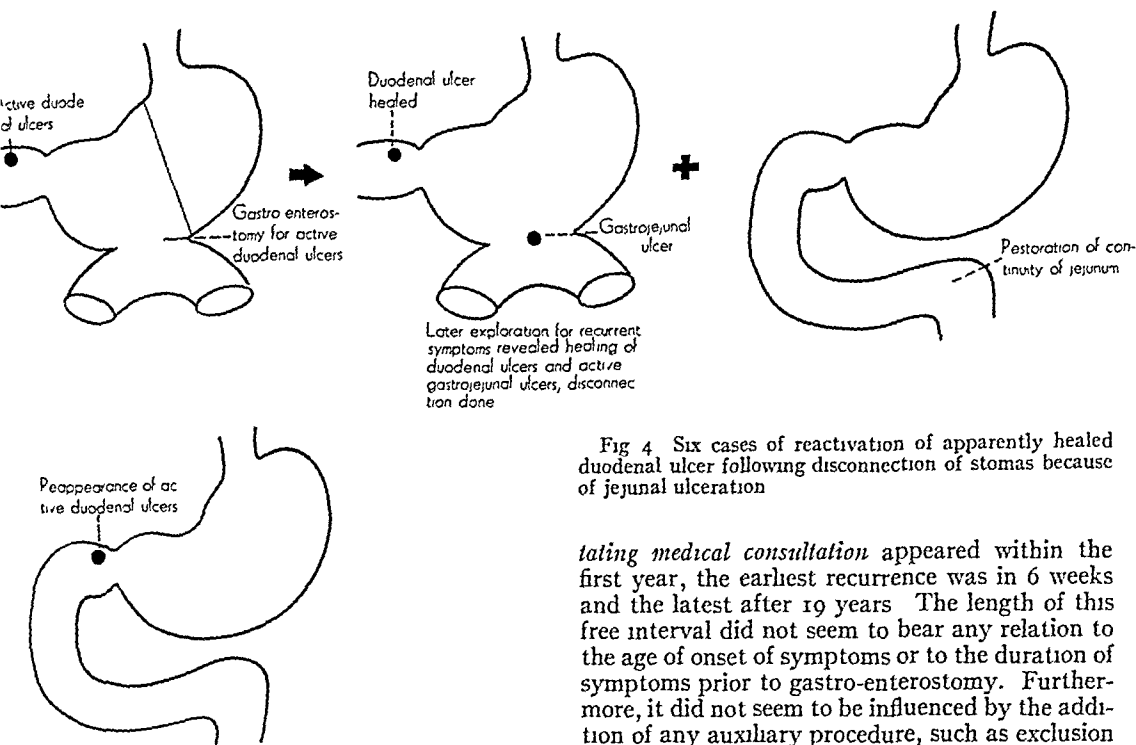


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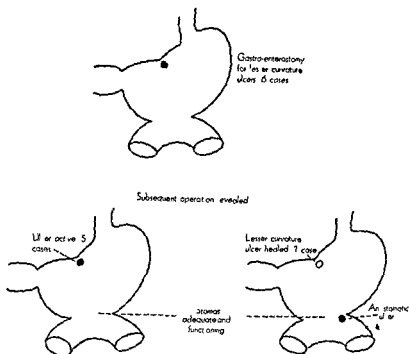


Fig 5 a top Six cases gastro-ente ostomy for lesser curvature ulcers b Subsequent operation revealed

bleeding was preceded accompanied or followed by ulcer symptoms

There were 4 patients with otherwise symptomless bleeding which was severe enough at times to reduce the hemoglobin to as low as 20 per cent. It is interesting to note that these specimens revealed superficial healing gastrojejunal ulcers. It must be borne in mind however that they were subjected to operation only after prolonged bed rest and medical treatment and it is not unusual to observe similar findings in specimens with primary duodenal ulcers which had been resected after comparable pre-operative treatment. The ulcerations in this type of case are superficial and show no tendency to penetrate into adjacent vessels. It is unlikely furthermore that the degree of penetration necessary to impinge upon either a mesenteric vessel or one branch of the middle colic artery could occur without inducing pain.

In view of the fact that conservative measures tend to induce healing of the ulcerations and that operative intervention in cases of anastomotic ulcer is such a formidable procedure it becomes a question of serious consideration whether this type of case, with painless bleeding should be treated medically rather than surgically.

In 9 patients there was bleeding associated with pain and in every instance the resected specimens showed no tendency toward healing. This type of case apparently presents a different therapeutic problem and seems more definitely to warrant operative intervention. We have encountered no instance of a fatal hemorrhage from a gastrojejunal or jejunal ulcer in this hospital.

Gastrojejunal colic fistulas. Perforation into the colon with a formation of a gastrojejunal colic fistula occurred in 8 patients and produced varying clinical pictures. In 4 instances the characteristic symptoms of foul eructations, fecal vomiting and diarrhea developed after a preceding history of pain which ceased in 3 patients with their onset. In 3 patients diarrhea and in 1 fecal vomiting were the first and only signs of trouble. A ray examination established the evidence of gastrojejunal colic fistula in 1 patient who at no time whatever manifested any clinical symptoms of its presence.

It may be mentioned in passing that every case of recurrent or anastomotic ulceration in this series showed the presence of free hydrochloric acid.

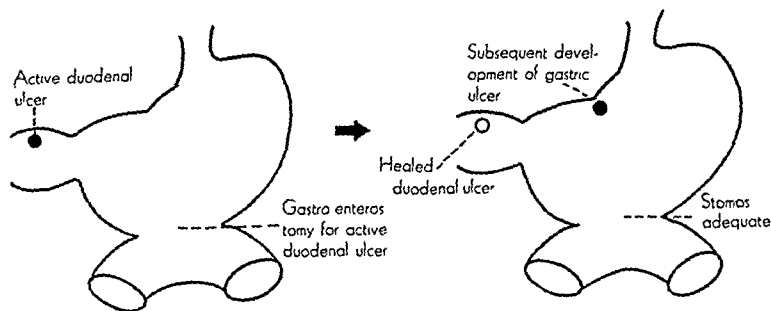


Fig 6 Six cases, development of gastric lesser curvature ulcers after gastro-enterostomy for duodenal ulcer

PATHOLOGY

The pathological characteristics of recurrent duodenal ulceration in 17 patients and of recurrent gastric ulceration in 11 patients were found to be identical with those of a typical chronic peptic ulcer and require no special consideration.

Pathologically distinct differences were found between the two types of anastomotic ulcerations. There were 29 jejunal ulcers of which 28 were located either in the efferent loop or directly opposite the stoma and only 1 in the afferent loop. These lesions were occasionally multiple, were definitely punched out in appearance, and were either of the same size or smaller than the ordinary duodenal ulcer. These cases of pure jejunal ulceration showed no tendency to involve the margin of the stoma which in every instance appeared to be quite normal. It would appear that operative technique can have little bearing on the development of ulcerations which are either opposite or at some distance from the stoma.

The characteristics of the marginal ulceration at the stoma, of which there were 21, are quite different from those found in the jejunum. They do not have their clear cut definition, are more irregular in shape and distribution, and show a tendency to follow the line of anastomosis and at times to involve a large part of its circumference. This infiltration usually resulted in a rigidity of the stomas, which, however, in most cases remained patulous, but in a few were stenotic. In several patients in whom a Murphy button gastro-jejunosomy had been performed, the stoma had shrunk to a size barely admitting the end of a good sized probe and resulted in a mechanically inefficient anastomosis. In these cases the presence of small granular excrescences and areas of polypoid and mucosal hyperplasia suggested that the stenosis might be the result of a previous inflammatory reaction. Incidentally, this was the type of case in which the duodenal ulcer remained

active and was responsible for persistent symptoms. While ulceration frequently extended from the stoma into the jejunum, it was never found on the gastric side of the anastomosis.

The tendency to penetration and chronic perforation was rather striking in these marginal and pure jejunal types of ulceration. These occurred in 29 patients and in 8 resulted in colonic fistulas, of which 4 were found to arise from jejunal ulcers and 1 from a marginal ulcer. In 3 patients the site of fistulous origin could not be established. In some cases penetration occurred against adjacent groups of small gut, and in others, especially where the ulcer was located directly opposite the stoma, it extended into the mesentery of the small intestine and resulted in considerable swelling and induration. In the case of one patient a previous operator reported the finding of a large mass of glands and exudate in the mesentery without evidence of ulceration. In most instances chronic perforations tended to become sealed off by the mesocolon or by the still intact wall of the colon, but as previously noted it resulted in colonic fistulas in 8 instances. How frequently perforation occurs into the free peritoneal cavity cannot be determined from this study, for that type of case naturally does not come to partial gastrectomy. However, there were 3 such patients in this series who had had a previous free perforation from an anastomotic ulcer before partial resection was performed. These tendencies to penetration and perforation are important factors in making operative intervention so difficult and hazardous in these secondary cases of anastomotic ulceration.

X-RAY DIAGNOSIS

While it is usually quite difficult and often impossible to differentiate the recurrent and anastomotic ulcerations by their clinical manifestations, x-ray evidence contributes much toward establishing their diagnoses.

Recurrent duodenal ulceration There were 17 patients who suffered recurrent duodenal ulceration in 11 of whom the gastro-enteric anastomosis was still present, and in 6 it had been disconnected. It will be recalled that in the first group the resected specimens revealed an inadequacy of the gastro-enteric anastomosis. X-ray examinations were available in 8 of these and indicated a deformity of the duodenum in all and stenosis of the stoma in 3 instances, irregular and poor functioning stoma in 2, high narrow stoma in 1, and a failure of visualization of the stoma in 2. A deformity of the duodenum was reported in all 6 patients who had had a disconnection of the stoma.

Recurrent gastric ulceration X-ray examinations were available in 7 of the 11 patients with recurrent gastric ulceration. In 2 instances the findings were negative, in 1 an hour glass constriction of the stomach was reported, and in 4 lesser curvature defects were noted.

Anastomotic ulcerations For practical purposes the x-ray findings in cases of marginal and jejunal ulcerations may be considered together. The signs establishing such a diagnosis were the presence of a pocket, a tender irregular stoma, gastric residue, and an irregularity or obstruction in the jejunum. There were 9 patients whose hospital record gave no report of a roentgen examination. Of the 41 patients who were subjected to x-ray examination in the hospital the report was positive in 15, suspicious in 6, and negative in 10. The accuracy of the x-ray investigation is actually greater than these figures would appear to indicate at first glance.

In 6 of the patients on whom the report was negative such findings are understandable as the radiological examination was undertaken after many weeks of medical treatment for severe hemorrhage. It will be recalled that in these cases the specimens revealed superficial healing ulcerations. There were however 3 definite cases of anastomotic ulcer which were reported negative.

There were 8 patients with gastrojejunal colic fistulas; the correct diagnosis was made in each instance. In 5 of these the barium meal showed direct passage of barium into the colon together with some deformity of jejunum or the stoma. In 1, the presence of a fistula was established only after the performance of a contrast enema.

THE EFFECTS OF OTHER CONSERVATIVE OPERATIONS

Twenty-three patients in this series of 86 unsuccessful gastro-enterostomies had been subjected to various types of conservative gastro-enteric

procedures in attempts to control their recurrent or persistent symptoms. Twelve patients had had 1 operation, 2 had 3 operations, 4 had 4 operations, 4 had 5 operations, and 1 had 6 operations before a partial gastrectomy was done. It is obvious that these cases merely represent a small series of failures and statistically are of no therapeutic significance. When their results however are viewed from the standpoint of the inferences suggested by a study of the resected specimens an interesting light is shed upon their rationale. They are presented solely for such consideration. It has been indicated that the effects of gastro-enterostomy are due largely to mechanical diversion and that the well functioning rather than the poorly functioning stomas are likely to ulcerate. Under such circumstances it would appear that in instances of anastomotic ulceration the creation of a new or a more efficient stoma or the excision of the actual lesion would offer very little expectancy of avoiding a recurrence. Such measures do nothing actually to alter the basic conditions which cause the anastomotic lesion and apparently permit a repetition of the factors responsible for its original appearance.

Disconnection of the stoma with the addition of a new anastomosis had been done in 8 cases. In 6 the gastro-enterostomy was posterior, the symptoms recurred within 1 year in 3, after 3 years in 1, and after 5 years in 2. In 2 patients in whom a new anterior gastro-enterostomy had been made apparently because of the impossibility of performing another posterior anastomosis symptoms had recurred in less than a year.

In 3 patients new gastro-enteric anastomoses were made without disturbing the original ones which were found to be contracted. In all 3 ulcerations developed at the new anastomotic sites.

Excision of the anastomotic ulcer with plastic repair had been performed 6 times with symptoms recurring in every case in less than a year.

An operation which recently has found some favor is a disconnection of the stoma with closure of the gastric defect and restoration of the continuity of the gastro-intestinal tract by reconstructing the jejunum. It is argued that if a duodenal ulcer recurs it is more amenable to medical therapy than an anastomotic one and if gastrectomy should become necessary later the previous disconnection of the stoma would make it a less formidable operation. It is evident from the experience with the patients in this series that this advantage does not necessarily occur. The procedure of restoring intestinal status quo had been performed 6 times in this series with a subsequent recurrence of the duodenal ulcer in every

instance. In 4 cases the symptoms returned almost immediately. The recurrence of ulceration made the dissection of the duodenum much more difficult and hazardous when these patients came to eventual partial gastrectomy, than it would have been at the time of the disconnection of the gastro-enterostomy when the duodenum was comparatively normal.

Although it may seem logical at this time to allude to the results obtained with partial gastrectomy or to the choice of the procedure favored for these cases, we feel the data of this communication do not permit such a presentation. It must be remembered that partial gastrectomy merely served as the medium for our observations concerning gastro-enterostomy and the cases considered were limited only to those in which satisfactory specimens were available for study. They do not include all the gastro-enterostomies which came to radical resection and they constitute a limited percentage of such patients seen in this clinic. When sufficient time has elapsed to allow a comprehensive evaluation of results, we plan to report the experiences of this clinic with partial gastrectomy for the patients previously unsuccessfully treated by gastro-enterostomy.

SUMMARY AND CONCLUSIONS

Partial gastrectomy through the media of its surgical exposure and the tissue resected, permits a direct study of the effects of previous operations upon the ulcer bearing area of the stomach and duodenum. Such a study is the basis for a consideration of the *modus operandi* of gastro-enterostomy and the nature of its complications. The cases of 86 patients with duodenal and gastric ulcer who had been subjected to partial gastrectomy after a previous unsuccessful gastro-enterostomy are reviewed. Their significant clinical, pathological, and radiological features are indicated. A study of the resected specimens suggests the following conclusions:

1 A mechanically efficient gastro-enteric stoma tends to cause the disappearance of an active duodenal ulcer

2 Failure of a duodenal ulcer to heal following gastro-enterostomy is often associated with mechanical inefficiency of the stoma

3 While a mechanically efficient stoma tends to bring about the healing of an active duodenal ulcer it seems also to favor the development of an anastomotic ulcer.

4 Co-existence of active duodenal ulcer and active anastomotic ulceration is uncommon

5 There are few objective evidences of healing associated with the disappearance of the duodenal ulcer following gastro-enterostomy

6 Observations are adduced which suggest that the changes induced in active duodenal ulcer by gastro-enterostomy resemble the latency of a remission rather than the permanence of a cure

7 Disconnection of gastro-enteric stoma because of anastomotic ulceration may result in reactivation of such latent duodenal ulcers

8 The effectiveness of gastro-enterostomy seems to be due as much to a mechanical factor as to chemical factors

9 Lesions at the level of or proximal to gastro-enterostomies (lesser curvature ulcers) are as a rule not as favorably effected as lesions distal to them (juxtapyloric ulcers). This would tend to emphasize the importance of the mechanical factor

10 In cases where gastro-enterostomy has induced remission of duodenal ulcers, ulcers of the lesser curvature have developed at a subsequent date. This would also tend to emphasize the importance of the mechanical factor in gastro-enterostomy

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THE EFFECTS OF OTHER CONSERVATIVE OPERATIONS

Twenty three patients in this series of 86 unsuccessful gastro-enterostomies had been subjected to various types of conservative gastro-enteric

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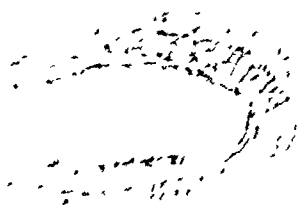
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REFRIGERATED CARTILAGE ISOGRAFTS

GERALD BROWN O'CONNOR, M.D., F.A.C.S., and GEORGE WARREN PIERCE, M.D., F.A.C.S.
San Francisco, California

FOR the past 5 years in the reconstruction of contour defects of the face and its appendages we have used exclusively what we call the "refrigerated cartilage isograft." Cartilage isografts are, for certain types of contour reconstruction, our material of choice as they are easy to obtain, will keep *in vitro* in definitely will not absorb, will resist infection, are pliable and will lend themselves favorably to sculpturing.

The cartilage mainly rib is obtained under sterile or unsterile conditions and stripped of its perichondrium. It is thoroughly washed with ordinary tap water to remove any blood which may have collected on the cartilage. This material is then placed in a covered sterile glass container and covered with a solution of 1 part aqueous merthiolate (1:1000) to 4 parts of sterile normal saline. The solution should completely cover all of the cartilage by at least 1 inch. The container is placed in the refrigerator and left there; it is taken out only when the solution has to be changed, cultured, or the refrigerated cartilage used for grafting purposes. When new material is prepared the solution is drained off and changed twice a week for 2 weeks and then only once a week thereafter. New cartilage material should not be added to the now sterile original container unless it has undergone the Merthiosaline treatment for at least 1 week and 2 cultures of the second preservative solution have been proved negative. We have made it a routine to obtain a culture from our merthiosaline solution every time a piece of refrigerated cartilage is to be used for reconstruction. We have never had a positive culture return from the preservative solution (merthiosaline) containing the refrigerated cartilage isografts in over 3,500 cases.

We have used refrigerated cartilage isografts as early as 24 hours after they had been placed in the merthiosaline and grafts that have been preserved for as long as 2 years, but we strongly advise that any cartilage isograft not be used until it has been refrigerated in the merthiosaline for at least 1 week and negative cultures of the solution are obtained by the operator. Refrigerated cartilage isografts that have been preserved over 6 months are just as efficient as a fresh batch of cartilage. This long waiting period although not advisable

does not materially affect the cartilage as a graft.

Macroscopically, the fresh cartilage and the older cartilage are identical except that some of the older material is slightly more pliable than when first obtained and, microscopically, occasionally small vacuoles are noticed in the sectioned cartilage that has been preserved over 2 weeks.

Of the 375 transplants done, local infection developed in 6 cases. This occurred mostly in grafts that were used to reconstruct the nasal bridge or tip where external sterilization is difficult. These infections responded to local treatment with all of the grafts remaining *in situ* except any portion of a graft that became exposed. The exposed portion of the graft was gradually digested or was surgically excised to speed up wound closure. This latter treatment was the usual procedure as it materially shortened the postoperative cure. If a refrigerated cartilage isograft becomes infected there are several alternatives—the whole cartilage graft may be removed immediately, the infection subsides rapidly and the wound heals in a short time. If good dependent drainage is established the graft can be left *in situ* and it will survive but healing will be delayed. On several occasions, to speed recovery where nasal bridge transplants were contaminated, intranasal or columellar drainage points were established and the graft irrigated with merthiosaline introduced through the nasal skin into the graft bed by hypodermic syringes. This should not be done under pressure and should be done only when through and through drainage has been established. The solution merely acting as an irrigator is injected into the graft cavity and not into the skin or subcutaneous tissue.

Only one total graft was removed and this was taken out because of a streptococcal infection through its point of introduction 48 hours after it had been placed under the skin of the nasal bridge. The symptoms subsided under local treatment as soon as the graft was removed and adequate drainage provided. This infected graft was thoroughly washed in saline solution, refrigerated in merthiosaline and kept for 6 months. It was then felt that the site to be grafted had recovered from its infection so the original graft was re-introduced. Healing occurred *per primam* this

time Infected cartilage that is removed can be resterilized, preserved in merthiosaline, and used again

After a 5 year waiting period we find that all of the refrigerated cartilage isografts that have been transplanted have retained their original size and identity, except those parts of the 6 grafts that became exposed and 1 small nasal bridge graft that entirely absorbed

The 1 graft that completely absorbed was $\frac{7}{8}$ inch long, $\frac{1}{4}$ inch high, and $\frac{3}{8}$ inch wide It was used to build up a luetic nose which was noticeably lacking in skin covering and mucosal lining The graft was unfavorably situated under tension and an opening occurred between the graft and the nasal cavity The continual mild infection plus the exposure of the graft gradually caused its disappearance An additional refrigerated cartilage isograft was used on this patient after a 6 months waiting period and that has remained *in situ* after 3 years

The refrigerated cartilage isografts are most efficient, highly satisfactory, and economical for the patient needing contour restoration Their use eliminates the pain and disability that accompanies a rib cartilage resection, which in itself is often more disabling than the correction of the deformity The use of cartilage isografts always gives one an abundance of easily obtainable material that is simply sterilized and kept on tap in the refrigerator where it is available at all times The refrigerated cartilage isografts can be interchanged regardless of age, sex, color, race, or blood grouping Cartilage young in years (under 16 years) due to its pliability is not good contour building material Refrigerated cartilage isografts stand infection well, will not absorb, and only occasionally cause slightly more of a local reaction than do autogenous grafts This reaction is not severe and when it subsides the resulting pericartilaginous fibrosis fixes the graft more firmly in its bed so that no movement is elicited on digital palpation This is a helpful sequela for it fixes the graft in its proper location. The cartilage isografts bend occasionally but with much less frequency than when only autogenous grafts are used This is probably due to the fact that when the perichondrium is removed and the cartilage placed in merthiosaline it assumes the shapes that the internal strains and stresses of the cartilage cells dictate Grafts can then be sculptured from this cartilage of the required shape to fit an existing defect Those few grafts that have bent out of position are the result of (1) the graft being too long for the pocket, (2) the external pressure as measured by the skin elasticity not being evenly

distributed over the graft. If the pressure is greatest in the middle of the graft one or both ends will be forced upward The pressure may be greater at the ends of the graft without materially bowing the center as this is the thickest part of the graft and there is less give to it On numerous occasions cartilage isografts were accurately sculptured and then placed in the merthiosaline which sterilized and preserved the graft until it was ready for use If any curling should occur it will take place in the solution and a correction can be made before transplantation is carried out

Over the years, for confirmation, we have presented to other surgeons our methods, technique, and the results of this work and from personal communications we find they have all been highly pleased with the results they obtained with this type of graft Dr Claire Straith reports his results but neglected to mention his source of information obtained from our original work

CONCLUSIONS

1 Cartilage isografts can be sterilized, preserved, and refrigerated in merthiosaline for an indefinite period of time The length of time of preservation does not materially affect the cartilage as a graft

2 Infected refrigerated cartilage isografts can be resterilized and preserved for use at a later time

3 Merthiolate (1:1000) 1 part and sterile normal saline 4 parts when refrigerated act as an efficient antiseptic and preservative for cartilage isografts

4 Refrigerated cartilage isografts are efficient and economical for the patient requiring reconstruction surgery They eliminate the necessity of rib cartilage resection, give one a storehouse of easily available material that can be interchanged regardless of age, sex, color, race, or blood grouping

5 Refrigerated cartilage isografts at times cause slightly more of a local reaction but this is a helpful sequela. They bend or curl with much less frequency than do autogenous cartilage grafts

6 Refrigerated cartilage isografts are, for certain types of contour reconstruction, our material of choice as they are easy to obtain; will keep *in vitro* indefinitely; will not absorb, will resist infection, are pliable, are easily sterilized, and will lend themselves favorably to sculpturing

We express our sincere appreciation to Dr A Moody and Dr S Leland, of San Francisco, for the co-operation and assistance they have rendered in helping to solve the many problems that confronted us in this work.

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SURGICAL CONSIDERATIONS IN REMOVAL OF STONES FROM THE KIDNEY

JAMES T PRIESTLEY M.D., F.A.C.S. Rochester Minnesota

DEFINITE advances, both medical and surgical have been made in the management of nephrolithiasis during recent years and consequently late results following the removal of stones from the kidney have been correspondingly improved. Accurate pre-operative roentgenologic localization of calculi has rendered diagnosis almost infallible, and as a result the surgeon usually knows the number, size, and location of stones that must be removed before the incision is made. Improvements in anesthesia and in surgical technique have not only reduced the risk of operation but have enhanced the likelihood of an ultimate satisfactory result. The importance of proper post-operative treatment has become widely appreciated. The present discussion however will be limited largely to mention of certain surgical considerations that seem significant in the removal of stones from the kidney.

EXPOSURE OF KIDNEY

As in other types of surgery, probably no single factor is of more importance in the surgical treatment of nephrolithiasis than adequate exposure. The type of incision which affords the best view of the renal fossa and permits mobilization of the kidney most readily, begins high in the costovertebral angle and follows the course of the last rib anteriorly approximately 1 centimeter below the lower border of the rib. Continuation forward to the downward prolongation of the anterior axillary line is usually sufficient. The incision may be carried as far forward as necessary, how-

ever, and its length is commonly determined by the size of the patient and by the relative position of the kidney. All muscles encountered along this incision down to and including the dorsolumbar fascia, may be severed without fear of subsequent herniation if proper closure of the wound is accomplished. Various muscle splitting incisions have been described, but these are more time consuming are unnecessary for a strong wound, and may limit exposure. Care should be taken to avoid the ilio-inguinal and iliohypogastric nerves which course just beneath the dorsolumbar fascia downward from the costovertebral angle immediately lateral to the erector spinae group of muscles. If the kidney is placed unusually high or is particularly adherent in the region of the upper pole or if it is fixed in a high position as the result of a previous operation, difficulty may be experienced in mobilizing it. In order to facilitate exposure under these circumstances the twelfth rib may be fractured by a direct upward pull and left *in situ*. If adequate exposure is not obtained in this manner, subperiosteal resection of the twelfth rib increases the height and the breadth of the incision and enhances the exposure of the upper pole of the kidney.

After the desired incision is made, the kidney may be readily exposed by opening the fascia of Gerota near the costovertebral angle and retracting this opening toward the midline. If there is much perirenal inflammatory reaction the peritoneum may be adherent to the anterior surface of the kidney and it should be carefully reflected in order to avoid entering the abdomen. If the

peritoneum is accidentally or purposely opened it should be closed before the pelvis of the kidney is opened

EXPOSURE OF RENAL PELVIS

In order to obtain the best view of the renal pelvis it is advisable to mobilize the kidney freely so that it may be raised well out of the depths of the wound. As an assistant holds the kidney directly upward from the wound, with one hand placed over each pole, which is covered with gauze, the renal pelvis may be identified posteriorly at the hilus of the kidney. Usually the peripelvic fatty tissue can be removed from the posterior aspect of the pelvis without difficulty. Occasionally, if there is much inflammatory reaction present, the peripelvic fat may be edematous, indurated, and adherent, and it cannot be readily separated from the pelvis. Usually, however, this tissue can be removed over a sufficient area to give an adequate view of the pelvis. Palpation of a calculus within the pelvis serves to identify the position of this structure with certainty. If one is uncertain about identification of the pelvis, however, a small aspirating needle may be inserted into the region in question in order to be certain before an incision is made. Should the needle inadvertently enter the renal vein, a moment's pressure with the finger is adequate to control bleeding. In a limited number of cases one finds the pelvis situated anteriorly, and, if after searching on the posterior aspect of the renal hilus the pelvis is not encountered, such an abnormal position should be suspected and a search made anteriorly. Should the pelvis not be readily located in this region, it can always be located by identifying the ureter and tracing it upward.

It is usually advisable to immobilize the wall of the pelvis in some manner before it is incised. Allis forceps may be employed for this purpose, or a single retraction suture may be placed on each side of the line of anticipated incision into the pelvis. As traction is made on the forceps or sutures, the anterior wall of the pelvis is immobilized and separated from the opposite wall, thereby eliminating any danger of incising both anterior and posterior walls at the same time. If the extrarenal pelvis is small, exposure of the pelvis may be greatly increased by placing two small, smooth, right-angled retractors against the renal parenchyma which overlies the pelvis and retracting toward the convex border of the kidney. The additional amount of pelvis that may be exposed by this method is oftentimes very surprising.

INTRARENAL EXPLORATION

After the pelvis is opened by an incision which is usually placed in the direction of its long axis, stones within the kidney can ordinarily be removed with little difficulty. Pre-operative knowledge of the exact location of a given stone within the kidney facilitates its discovery at the time of operation.

Various types of forceps bent in the distal portion at a wide variety of angles have been designed and may be used in performing pelvicolithotomy. The ordinary Mixer forceps is quite satisfactory in a high percentage of cases. In exploring the interior of the kidney with forceps one should always exercise great care not to tear the mucosal lining of the pelvis or calyces. Such trauma leads to bleeding, to injury to the parenchyma, and adds to the difficulty of locating and removing calculi. If a stone remains that cannot be located with the forceps, exploration of the interior of the kidney with the tip of the finger, if the pelvis is of sufficient size, is one of the most satisfactory methods of determining for certain whether any calculi remain. Instruments for visualization of the interior of the kidney have been described, but these are not always satisfactory and as a rule are not necessary.

COMPLETE REMOVAL OF ALL STONES

The importance of completely removing all calculi and stony fragments cannot be overemphasized. Undoubtedly many so called cases of recurrence are not in fact true recurrences but merely represent the persistence and perhaps growth of calculi or portions of calculi which were present but not removed at the first operation.

In addition to accurate pre-operative knowledge of the number, size, and location of the calculi, and careful intrarenal exploration with forceps and perhaps with the finger, there are other aids to complete removal of all stones. Small stones and sandy material may oftentimes be evacuated by lavage of the pelvis and calyces with sterile water or saline solution. This may be accomplished by inserting the nozzle of a syringe directly into the pelvis or by using a soft rubber catheter that is placed at any desired point within the kidney.

The use of roentgen rays at the time of operation obviously is most desirable. Fluoroscopic examination by a trained roentgenologist in a darkened operating room is usually of great value to the surgeon who is searching for an unlocated calculus. In addition to the fluoroscopic examination, a roentgenographic plate taken at the time of operation and developed immediately by

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DEFINITE advances, both medical and surgical, have been made in the management of nephrolithiasis during recent years, and consequently late results following the removal of stones from the kidney have been correspondingly improved. Accurate pre-operative roentgenologic localization of calculi has rendered diagnosis almost infallible, and as a result the surgeon usually knows the number, size and location of stones that must be removed before the incision is made. Improvements in anesthesia and in surgical technique have not only reduced the risk of operation but have enhanced the likelihood of an ultimate satisfactory result. The importance of proper post-operative treatment has become widely appreciated. The present discussion, however, will be limited largely to mention of certain surgical considerations that seem significant in the removal of stones from the kidney.

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Fig 1 a, left, Original roentgenogram, showing numerous calculi in the left kidney, b, intravenous urogram, showing horseshoe kidney with good function on both sides

mandelic acid usually give good results in the treatment of bacillary and *Streptococcus faecalis* infections. Other coccal forms and the *Bacillus proteus* are usually best treated by sulfanilamide. This latter drug is preferably withheld until it has been determined that mandelic acid has been ineffective. Occasionally, neoarsphenamine may be employed in the treatment of coccal infections which have proved resistant to other types of treatment. Approximately 40 per cent of renal calculi are associated with infection (1). All distant foci of infection should be eradicated.

Certain metabolic errors at times appear to be responsible for the formation of renal calculi. A chemical analysis of the removed calculus should always be made as this may shed light upon possible metabolic errors, especially if stones composed of cystine or urates are detected. In recent years hyperparathyroidism has been emphasized as a cause of nephrolithiasis, and vitamin deficiency has also been stressed. That these abnormalities may occasionally be directly related to the formation of urinary calculi appears to be fairly well established, but that they are a common cause of renal stones in this country seems

extremely unlikely. These possibilities, however, should be considered in the treatment of each patient with urinary lithiasis as only by combined medical and surgical management will the best immediate and end-results be obtained.

Surgical aspects As a result of widespread interest in these newer conceptions of the etiology of renal calculi, certain older, well recognized anatomic abnormalities which are frequently associated with calculi have received little consideration. Stasis caused by various types of obstructive lesions is often found to be present when stones are removed from a kidney. The ease with which infection appears in the presence of stasis and the difficulty of rendering the urine sterile under such conditions is well known.

The kidney which contains a stone often shows some evidence of pyelectasis and caliectasis. Whether the obstruction which caused this hydronephrosis is primary and the formation of the calculus secondary, or vice versa, is sometimes difficult to determine. Too often, however, it is more or less assumed that the stone is the cause of the hydronephrosis, and a careful search is not made for any possible extrinsic cause for obstruc-

portable equipment located nearby affords definite information as to whether or not all stones have been removed. Nephrolithotomy may be necessary at times to remove one or two stones which remain. When one is satisfied there are no remaining calculi, the pelvis may be closed by several interrupted stitches of catgut. The line of closure of the pelvis may be covered, if one desires, by the nearby peripelvic tissue.

NEPHROLITHOTOMY

When a large branched stone is present, or when a calculus is located in the calyx the isthmus of which is too small to permit removal of the stone through the pelvis without undue trauma, nephrolithotomy may be advisable. When marked caliectasis is present and the cortex is accordingly very thin, an incision through the cortex in order to remove a calculus causes very little damage to the kidney and may obviate the necessity of a technically difficult pelvolithotomy. At times the location of the most desirable area on the cortex from which to extract a calculus situated in a calyx may be advantageously determined by pressing the finger which has been inserted through the pelvis against the calculus, thereby forcing it against the cortex and making it more easily located on the parenchymal surface of the kidney. The palpation of a soft area on the cortex also serves to identify a dilated calyx which contains a calculus.

An extensive incision in the cortical surface of the kidney from one pole to the other along the convex margin is seldom required. When extracting a large branched calculus that fills the pelvis and all calyces such a procedure may be necessary. When the kidney is incised so generally, loss of blood can be greatly reduced and exposure enhanced by temporary compression of the renal pedicle with a large rubber covered clamp. Following removal of the stone, large individual bleeding points should be ligated by mattress sutures before the cut surfaces of the kidney are approximated by a similar type of suture. This is accomplished by mattress sutures tied over small pieces of muscle. The renal capsule may then be reunited by a continuous suture.

NEPHROSTOMY

If the kidney is extensively damaged as the result of longstanding partial obstruction if considerable infection is present, if infection with *Bacillus proteus* exists if there is any doubt concerning adequate drainage from the kidney, or if there is much bleeding into the pelvis or calyces after stones have been removed it is usually

advisable to perform nephrostomy. The advantages of nephrostomy under such circumstances have been frequently discussed. It is desirable to have the nephrostomy tube leave the renal pelvis through the lower calyx and traverse the various layers of the wound in as straight a line as possible. This is especially important if one anticipates the necessity of keeping the tube in place for a considerable period of time. When the tube is so placed, a straight tract results and changing of the tube is thereby facilitated. If nephrolithotomy has been performed the nephrostomy tube may leave the kidney through the nephrotomy incision in order to avoid additional damage to the renal parenchyma. Multiple nephrostomy tubes may be inserted if desired, though this is seldom necessary. It is always important to make certain that the nephrostomy tube is placed dependently in the renal pelvis or has an opening in the portion of it that is in the dependent part of the pelvis. In addition to providing excellent renal drainage during the early postoperative period, drainage by nephrostomy may be maintained permanently should this be necessary. A nephrostomy tube may also be utilized for lavage of the renal pelvis and aspiration of inspissated material which might form the nidus of a subsequent calculus.

PREVENTION OF RECURRENCE

In the past, the incidence of recurrence of renal calculi has been variously estimated at from 10 to 40 per cent. At present I believe that the frequency of recurrence is definitely less in properly treated cases. Nevertheless stones reform in the kidney sufficiently often following complete surgical removal to merit careful consideration of this possibility in the treatment of each patient. Adequate treatment includes adherence to certain general medical and surgical principles.

Medical aspects. From the medical point of view the importance of infection in the urinary tract has received well considered emphasis. Every patient who has a calculus in the kidney should have careful bacteriologic studies made of the urine both before and following removal of the stone. At the same time the hydrogen ion concentration of the urine should be determined. Adequate treatment necessitates complete eradication of all bacteria from the urinary tract before the patient is dismissed. Preferably, three consecutive negative cultures should be obtained. Treatment will vary depending upon the type of organism present. The management of infection in the urinary tract will not be discussed in detail but in general, proper acidification and the use of



Fig 3 a, left, Plain roentgenogram, 18 months after operation, showing no calculi in urinary tract, b, intravenous urogram, 18 months after operation, showing normal renal function and reduction in size of left renal pelvis

at which time the ureter was anastomosed to the dependent portion of the renal pelvis. The immediate postoperative convalescence was quite satisfactory. Considerable difficulty was experienced in eliminating all infection from the left kidney and, before this was accomplished, several recurrent¹ calculi lodged in the ureter and were removed transurethrally by Thompson and Cook. Within several months following operation the urine was sterile and after this no more calculi formed. Examination of the patient, March 23, 1937, revealed a sterile urine, normal renal function, and reduction in size of left renal pelvis (Fig 3).

OPERATION FOR RECURRENT STONES

When confronted with the necessity of removing recurrent renal calculi, operation is always more difficult than in primary cases. The kidney is firmly embedded in dense, fibrous tissue, adherent to the peritoneum on its anterior surface, and mobilization must often be accomplished by sharp dissection. A kidney which has been operated on previously and which contains recurrent calculi is never in normal condition and should be traumatized as little as possible. If complete mobilization of the kidney under these circumstances involves excessive trauma to the renal parenchyma, it may be advisable to mobilize the kidney as little as possible. It is oftentimes

¹Known to be recurrent because these calculi were composed of calcium phosphate and the original stones were calcium oxalate.

possible to remove stones through the pelvis without mobilizing the kidney to any appreciable extent. If this is not feasible, it may be desirable to perform nephrolithotomy in order to avoid the trauma of unnecessary mobilization. A dilated calyx can often be opened on its cortical surface and a stone removed with little damage to the parenchyma.

CONCLUSIONS

In general, stones may be removed from the kidney with a low initial operative mortality and with the legitimate expectation of excellent ultimate results in the majority of cases if certain general principles are followed.

Careful surgical management together with adequate and proper medical care, which include complete elimination of infection from the urinary tract and consideration of any metabolic, endocrine, dietary, or chemical abnormalities, are essential if the best results are to be obtained.

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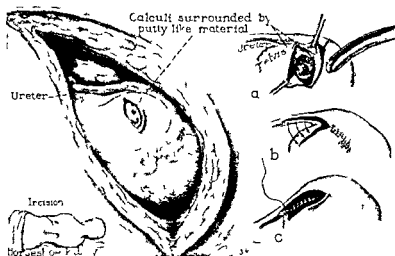


Fig. 2 Drawing made at time of operation showing removal of calculus from renal pelvis and plastic operation on ureteropelvic juncture

tion Whenever a calculus is removed the region of the ureteropelvic juncture should be exposed and examined to determine if there is any evidence of interference with free drainage from the kidney. When the pelvis is opened, the diameter of the ureteropelvic juncture can be readily ascertained by passing a catheter or curved forceps into the upper portion of the ureter. Anomalous vessels, high insertion of the ureter into the pelvis, constricting fibrous bands or other causes of obstruction may be present. When one finds definite evidence of an organic cause for faulty drainage from the kidney, this should be corrected. If this is not done, stasis of varying degree persists after removal of stones and not only is the possibility of recurrence increased but damage to renal parenchyma is progressive.

Surgical treatment depends on the type of obstruction that is present. The numerous details of the conservative surgical management of obstruction in the region of the ureteropelvic juncture will not be discussed. (2) Suffice it to say that the main idea of all such procedures is to establish free and dependent drainage from the renal pelvis. To accomplish this purpose it is often necessary to vary the surgical procedure according to the exact anatomic condition that is encountered. Such a plan is more desirable than endeavoring to adopt one particular surgical technique to every case that is encountered. Plastic operations on the renal pelvis or ureter can in many cases be combined with pyelolithotomy or nephrolithotomy quite satisfactorily.

If considerable infection is present it may not be advisable to carry out any procedure other than removal of the stones and drainage of the kidney by nephrostomy. Under these conditions too extensive an operation which necessarily involves some trauma to the renal parenchyma might jeopardize the entire kidney by increasing the likelihood of an extensive parenchymal infection during the early postoperative period. It may therefore at times be necessary to be content with correction of the most urgent condition and subsequently to consider further operation if this is essential to continued satisfactory renal function. An illustrative case follows.

A woman aged 21 years registered at the clinic on October 4, 1935, complaining of intermittent pain in the left renal region of 1 year's duration. Episodes of chills, fever, dysuria and frequency of urination had occurred. The patient's health was otherwise good. Clinical investigation revealed multiple calculi associated with a moderate degree of infection in the left half of a horseshoe kidney. The right half of the kidney seemed to be in good condition and was free of infection (Fig. 1). Operation was performed October 10, 1935.

Exploration through a left posterolateral incision revealed a horseshoe kidney, the left half of which appeared to be in good condition except for an enlarged pelvis which contained multiple small soft stones. The pelvis presented anteriorly and it was noted that the ureter inserted high up on the medial side of the pelvis, a condition which obviously interfered with adequate drainage of the kidney (Fig. 2). The ureter passed in front of the isthmus which connected the two kidneys, but there was no evidence of obstruction in this region. The pelvis was opened and numerous small stones were removed. Fluoroscopic examination and a roentgenogram made at this time showed no other calculi. Ureteropyeloneostomy was then performed.



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possible to remove stones through the pelvis without mobilizing the kidney to any appreciable extent. If this is not feasible, it may be desirable to perform nephrolithotomy in order to avoid the trauma of unnecessary mobilization. A dilated calyx can often be opened on its cortical surface and a stone removed with little damage to the parenchyma.

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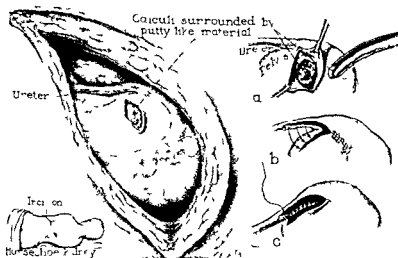


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close to the costochondral junctions. If a wider flap was desired he advised more lateral division of the ribs themselves. He did this quickly and with a successful outcome on a 20 year old girl with a stricture of the lower esophagus. The wound healed *per primum* and when examined 7 weeks later there was firm fibrous union of the costal cartilages.

Willy Meyer, in 1904 and 1905, had two occasions to resect the costal arch, enabling him more conveniently, first, to explore an esophageal stricture, and, second, to resect a huge sarcomatous spleen. He used a U-shaped incision in 1 case, and a combined longitudinal-transverse incision in the other, with division of the fused cartilages medially and laterally near the margins of the seventh, eighth, ninth, and tenth ribs. Both patients made good recoveries. He also suggested division of the ribs more laterally for wider exposure.

Wiener, in 1908, used multiple skin incisions and raised a left costal flap in a 45 year old woman with cancer of the cardiac stomach and esophagus. The pleura was injured, and resutured. Emphysema of the chest wall and neck developed rapidly on the first and second days, and lasted 2 weeks. The patient died after secondary operation for removal of the cancer 30 days later.

Between 1908 and 1929, a period of great advances in surgery, no further reports could be found. H. W. Meyer, in 1929, reported 2 cases, 1 in which he helped W. Meyer in 1924 turn up a left costochondral flap to facilitate anterior gastroenterostomy high near the cardia, in a patient with totally obstructing, inoperable carcinoma of the pyloric stomach. In the second patient, who had a spleen lacerated by a gunshot wound, H. W. Meyer raised a left costal flap by dividing the fused seventh, eighth, and ninth cartilages close to the manubrium sterni and by then dividing the outer ends of the seventh to tenth costal cartilages close to the bony ribs. The patient made a good recovery. Meyer recommends wider use of this chondroplastic resection of left costal arch.

Bickham describes an essentially similar method of temporary resection of the left costochondral arch with variations described as the Baudet-Navarro and Sonnenberg techniques.

Every attempt should be made to increase the reasonably safe operability of especially high lesions of the upper abdomen. One of the many disappointing pathologic findings of ulcer or cancer of the stomach is often the high extension of the lesion, whether benign or malignant, on the lesser curvature or fundus, even to encroach on the lower esophagus. Often one of the chief de-

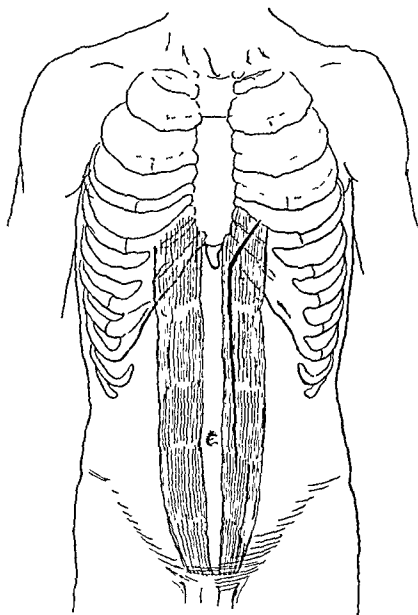


Fig 1 Outline of the incision. Note that the upper end of the incision turns sharply to the left, cutting some of the rectus muscle fibers transversely, or obliquely, and going through the costal arch. Note also the extension of the incision well down the abdomen below the umbilicus. Muscle retracting incisions we have preferred.

cisions against operability lies in the inaccessibility of the area. Or, if the operation is carried out, usually great difficulty in exposure is encountered, due first to the surgical anatomy of the stomach. The stomach, when empty, lies far back in the abdominal cavity, beneath the left lobe of the liver, and in front of the pancreas. The cardiac portion lies high under the left costal arch, beneath the left lobe of the liver. The cardiac orifice lies beneath the left seventh chondrosternal articulation, 1 inch to the left of the sternum. The gastrohepatic mesentery may often be short, thickened, and inelastic, especially toward the proximal end of the stomach. This renders especially difficult the mobilization of the cardiac end of the stomach, and necessitates carrying out the anastomosis deep in the abdomen, high under the costal arch.

Furthermore, in repair of diaphragmatic hernia, the transabdominal approach has been preferred by many, and we have found it satisfactory in some cases. One of the chief difficulties, however, has been exposure in the region of the hernial opening in the diaphragm, so that after reduction of the hernia, a firm closure of the diaphragmatic hiatus may be accurately carried out.

CUTTING THE COSTAL ARCH FOR UPPER ABDOMINAL EXPOSURE

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DURING the past 2 years we have been able to obtain added exposure in difficult upper abdominal operations by cutting the costal cartilages of the left sixth and seventh ribs and then retracting the chest wall. This maneuver has added very materially to the ease of certain high resections of the stomach and to the abdominal exposure and repair of diaphragmatic hernias.

We were at first somewhat hesitant to add this extra procedure to serious upper abdominal operations. Although it is generally recognized that adequate exposure of the operative field is the first principle of surgery, we have avoided any radical steps to obtain this exposure. Longer incisions, greater trauma, extra time, and increased blood loss are all factors in the production of operative shock, and must be reduced to a minimum. On the other hand, however, it is a fact that in our experience the increased facility of operation, after cutting the costal cartilages, overbalances any increment of shock caused by the procedure.

Attempts at increasing upper abdominal exposure by supplementary operations on the lower thoracic cage have been sporadically reported since Micheli's work on cadavers in 1895. His proposed method of turning up a wide flap including ribs, diaphragm and parietal pleura was quickly recognized as far too radical and shocking to add to the major abdominal operation, i.e. gastrectomy or splenectomy.

Outstanding surgeons of the German school from 1898 to 1908 published less radical modifications which in a few instances were tried on the living patient (Mikulicz, Asthøwer, Marwedel, W. Meyer, Wiener). Most of the patients died either from the advanced malignancy of the stomach or esophagus or from the operation.

Elevation of the left lower costal outlet as a supplementary procedure in abdominal surgery was first done in the living patient in 1894 by Asthøwer (not reported until 1903, contesting Marwedel's priority). To remove a 7 pound fibroma of the spleen in a 59 year old male he made three incisions. First at the outer border of the left rectus muscle, second transversely to the left to the tip of the eleventh rib, third from the

eleventh rib up over chest wall parallel to the first incision. Then he cut the eighth, ninth and tenth ribs laterally and their fused costal cartilages medially to raise an osteoplastic flap. The patient died on the following evening. He performed a second operation in 1901 on a 45 year old male with sarcoma of the left chest wall and used an oblique incision, from the ensiform cartilage to the tip of the eleventh rib. He divided the seventh costal cartilage near the midline and the eighth, ninth and tenth ribs laterally in the mid axillary line. The sarcoma was inoperable and the patient died on the seventeenth day.

By 1895 an extensive procedure for elevation of a costal flap had been worked out on the cadaver by Lannelongue and by Micheli (Tenth Italian Surgical Congress 1895). By this method the eighth to eleventh ribs were divided laterally and their fused costal cartilages medially forming a large flap with its base upward and including ribs, diaphragm, and parietal peritoneum. It was widely condemned by surgeons as too bloody and dangerous. A supplementary procedure (Kelling (6), Marwedel) to be carried out in the living patient.

Mikulicz raised a costal flap in 2 patients (October, 1896 and August 1899) for resection of cancer of the cardiac stomach and esophagus. Death occurred 30 hours and 24 hours later respectively (reported in detail by Gottstein). Similar to the method described above he raised a large costal flap by dividing the fused costal cartilages medially and the ribs laterally up to the sixth interspace, using multiple skin incisions in 1 case and a U shaped skin incision in the other.

Kelling attempted to avoid cutting the thoracic cage and sought exposure of the subdiaphragmatic area by allowing the pelvis and legs to hang vertically over the end of the operating table. The upper abdominal viscera were thus pushed forward and exposure was further aided by division of the suspensory ligament of the liver. He believed this to be a less shocking procedure and an easy position to obtain.

Marwedel many times on the cadaver (1901-1903) raised a cartilaginous flap by division of the costal cartilages close to the sternum and also

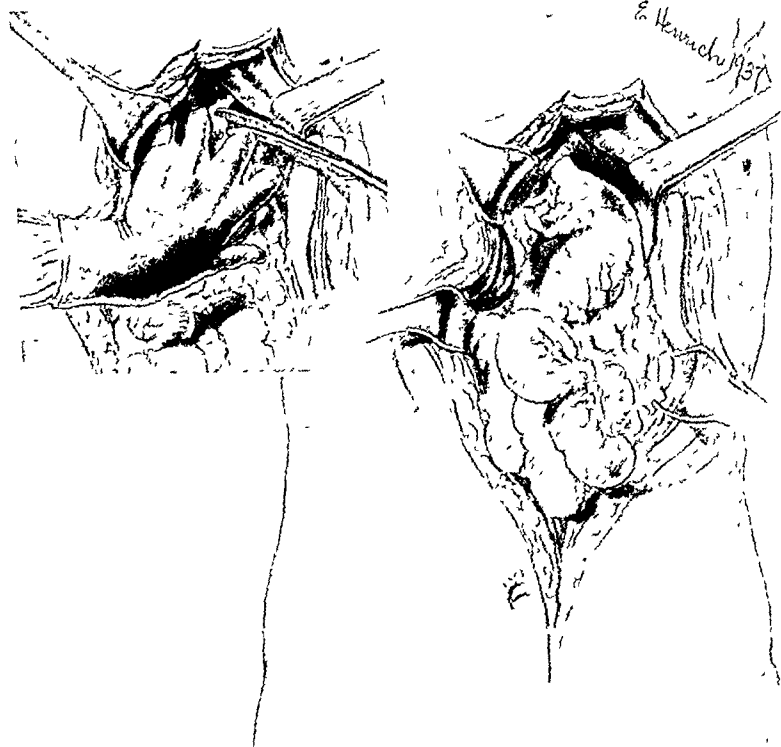


Fig. 3 Insert shows cutting the lateral ligament of the left lobe of the liver. The main drawing shows the left lobe of the liver retracted after the ligament is cut, the left chest wall elevated and retracted after the sixth and seventh costal cartilages are cut, the greatly improved exposure of the diaphragm, and the cardiac portion of the stomach is demonstrated.

leaf the left lateral ligament of the liver (Fig. 3). This attachment is avascular and may be divided freely, with generous retraction of the left hepatic lobe toward the right abdomen. The deep areas of the wound are protected with gauze, retractors are put in place, and a wide exposure of the upper abdomen is thus obtained.

On completion of the operation, the left lobe of the liver is gently replaced, without suture of the divided ligament. The left lower thoracic cage is allowed to fall into its normal position, and no attempt at reunion is made by drilling or suturing the cartilages. The posterior and anterior rectus sheaths are closed separately, and a small rubber dam drain is placed in the subcutaneous areas at the upper and lower angles of the incision.

Although the number of cases in which this procedure has been used by us is relatively few, no complication related directly to the procedure has

been noted. There has been no increased hospitalization nor morbidity attributable to it. There has been no evidence of unusually delayed wound healing, necrosis, drainage, or suppuration.

CASE 1. Mr. A. W., a 54 year old Russian male, was operated upon (H. M. C.) on November 11, 1936, for a large indurated malignant appearing ulcer measuring 5 by 3 by 3 centimeters and lying high on the lesser curvature of the stomach. An upper left rectus incision was made. On exploration there were found no metastases. A high gastric resection was carried out so as to leave one-fifth or less of the stomach, which was anastomosed to the jejunum according to the posterior Pólya method.

During the anastomosis, which lay so deep and high in the abdomen that safety hinged on added exposure, the incision was enlarged upward and obliquely to the left, cutting through the left rectus sheath and muscular attachments. Thus the fused sixth, seventh, and eighth costal cartilages were clearly exposed. The latter were then cleanly incised with the scalpel, with care to avoid injury to the pleura. The left lower thoracic wall could then be retracted well to the left without force. The anastomosis was



FIG. 2. Cartilages of the sixth and seventh ribs have been cut and the chest wall below has been retracted upward and outward. Care must be taken not to cut the internal mammary artery or enter the pleural cavity.

To obtain an increased exposure and thereby increased safety in carrying out these operations we have added to our technique the following measures: (1) Section of the fused left sixth and seventh costal cartilages and (2) mobilization of the left lobe of the liver as suggested by Grev Turner. We have used these procedures on two occasions for nearly total resection of the stomach and on two occasions for the repair of diaphragmatic hernia. Our experience and the good results obtained in these patients have demonstrated to us the usefulness of the maneuver and its possibly wider applicability in surgery of this region. It is especially helpful in obese barrel-chested patients and in those with a narrowed costal arch and smaller operative field.

We have had no hesitation in using this method wherever added exposure might increase the safety of the operation. We have had no particular difficulty with it except possibly the rare presence of ossification of the costal cartilages in the elderly patient. In such an instance bone forceps would

be required instead of a simple section of the fused cartilages with the scalpel. In 1 case we entered the pleural cavity, but immediate suture of the hole was made and no difficulty followed.

The technique which we have adopted in these cases is as follows. We prefer a small left rectus muscle retracting incision through which the abdomen is first explored. If we determine that the lesion is operable the incision is enlarged downward well below the umbilicus and upward to the edge of the left costal outlet. Graham gains much added exposure by carrying the incision well up over the chest wall at least 1 inch above the costal margin through all the soft tissues. He comments on the increased exposure obtained by this simple generous upward extension of the abdominal incision thus allowing better retraction of the rectus muscle and fascia. With this we are in agreement and in most cases this gives all the exposure required.

In certain cases however it is apparent that further exposure is desired. The skin incision at the upper angle is then deflected laterally 45 degrees and is carried through the skin and subcutaneous tissues upward and outward for 2 inches over the left costal cartilages (Fig. 1). This incision is carried deep across the medial attachments of the left rectus muscle thereby exposing clearly the usually fused cartilages of the sixth, seventh and eighth ribs. The left hand is carried into the abdomen beneath the left costal outlet to outline the position and height of the underlying diaphragm. With the ordinary scalpel the left sixth and seventh fused costal cartilages are cleanly divided 1 inch to the left of the sternum. The incision is carried not perpendicularly through the cartilages but rather obliquely upward toward the left midclavicle in direction (Fig. 2).

Care must be taken to avoid the underlying internal mammary artery when this vessel is cut it can best be controlled with suture ligatures. The underlying muscle of the diaphragm will usually be thick so that possible division of some of the muscle fibers will give warning to guard against further incision and injury to the closely adjacent pleura. If the pleura is opened it must be closed at once by pack and suture.

Having completed the procedure the left lower thoracic cage is gently retracted laterally. This gives an amazing increase in the ease of approach to the upper end of the stomach. Mobilization of the left lobe of the liver is next carried out if still greater accessibility is needed. This is done according to the technique described by Grev Turner. The hand is passed up over the left lobe retracting it downward thereby bringing into re-

5 The hazards, namely, tearing of the pleura and hemorrhage from the internal mammary artery, should be recognized, that they may be avoided

6 The technical steps are described and illustrated in 4 patients

7 Mobilization of the left lobe of the liver as described by Grey-Turner was used to complete the exposure in 1 patient, and the method is reviewed technically here

8 No complication, delayed wound healing, or morbidity resulted from the cartilage-cutting procedure in these 4 patients

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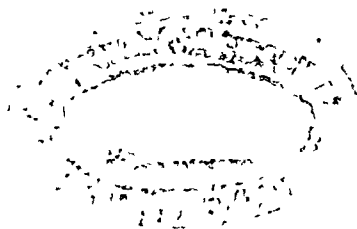




Fig. 4 Photograph of patient having very high resection of the stomach with cutting of the costal arches 6 months previously

completed with relative ease. The incision was closed in layers without special attention to the cut costal cartilages which were allowed simply to fall back into position. A small rubber dam drain was laid down to the cartilages at the upper angle of the incision.

The patient was given a transfusion, made an uncomplicated recovery and left the hospital on the sixteenth day with primary wound healing. The pathologic report showed gastric ulcer and no malignancy. At examination 1 month and 4 months later respectively the wound was solidly healed.

CASE 2. Mr. L. M., a 58 year old Syrian male was operated upon (H. M. C.) on April 22, 1937 for carcinoma high on the lesser curvature of the stomach, attached posteriorly to the pancreas. There were no evident metastases. High subtotal gastrectomy was done with a posterior Polya anastomosis. In order to gain further exposure and to complete the high anastomosis the approach to which was very difficult, the fused sixth and seventh cartilages on the left side were cut. The anastomosis was then completed without incident. The wound was closed in layers, supplemented by retraction sutures through the entire abdominal wall. The patient was given a transfusion, ran an afebrile course (highest temperature 99.2 degrees on the third day) and was discharged on the twentieth day with primary wound healing. Examination at 1 month and 6 months (October 1937) respectively showed the wound to be strongly healed (Fig. 4). The pathologic report showed adenocarcinoma grade II-III with no regional metastases.

CASE 3. Mr. R. V. L., a 52 year old American male, complained of indigestion for 1 year and vomiting after meals for 3 months. Clinically and roentgenologically he was thought to have a diaphragmatic hernia. On March 12, 1937, a left temporary phrenic nerve interruption was done. Five days later transabdominal exploration (H. M. C.) was carried out. Exposure was obtained at the outset by dividing the fused sixth and seventh costal cartilages just to the left of the ensiform process, and by dividing the diaphragmatic attachment of the left lobe of the liver according to the method described by (Key Turner).

A thin walled diverticulum about 7 centimeters in diameter of the lower third of the esophagus was found. There was no diaphragmatic hernia. The esophageal hiatus was enlarged and the diverticulum freed from pleura and dia-

phragm. During the procedure the left pleural cavity was opened and at once resutured. Just at the close of the dissection a hole was torn at the junction of the esophagus and the diverticulum. The diverticulum was therefore brought below the diaphragm and marsupialized by suturing it to the skin at the upper angle of the wound. A large cigarette drain was placed down to its base and the abdomen was closed in layers. Closed thoracotomy drainage of the left lower chest was then carried out, followed by transfusion.

Following operation the patient did well for 6 days, when he developed signs of bronchopneumonia in both lung fields. On the tenth day gastrostomy under local anesthesia was done for feeding. He died on the twelfth day following operation. Autopsy showed bilateral bronchopneumonia and localized peritonitis in the upper abdomen. We could not associate any of his troubles with the incision we had used.

CASE 4. Mrs. N. H., a 35 year old American housewife was operated upon (H. M. C.) on July 28, 1937 for diaphragmatic hernia. The left phrenic nerve was crushed 2 days previously to immobilize the left diaphragm. An upper left rectus muscle splitting incision was made. The left sixth and seventh costal cartilages were cut close to the midline and the ribs were retracted laterally. The herniated stomach was reduced into the abdomen. The 5 centimeter slit like opening at the esophageal hiatus was closed securely with heavy silk. The abdomen was closed in layers without special attention to the costal cartilages. Recovery was uneventful with primary wound healing and the patient was discharged on the fifteenth day after operation.

Examination 7 months later February 10, 1938 showed the wound strongly healed and x ray examination showed no recurrence of the hernia. Intermittently she had noticed slight tenderness at the upper angle of the incision which had been at no time severe.

SUMMARY

Attention has been directed to the technical usefulness of a relatively simple maneuver for obtaining added exposure in surgery of the upper abdomen. Avoidance of the more radical "costal flaps" in favor of this simplified procedure has been advocated. The help obtained from this added maneuver is shown in the 4 cases reported herewith.

CONCLUSIONS

1. Restricted exposure high in the upper abdomen may reduce safety of operation.
2. Elevation of a left "costal flap" as a supplementary procedure in abdominal surgery has been reported sporadically since 1895. Because of the added trauma involved it has met slow acceptance by clinical surgeons.
3. Mobilization of the left lower costal outlet may be simplified without recourse to a complete costal flap in the usual case by cutting the sixth and seventh costal cartilages.
4. The procedure has been used in 4 patients during the past 2 years with technically gratifying results. Added operating time and shock were minimal and safety of suture lines was greatly increased.

5 The hazards, namely, tearing of the pleura and hemorrhage from the internal mammary artery, should be recognized, that they may be avoided

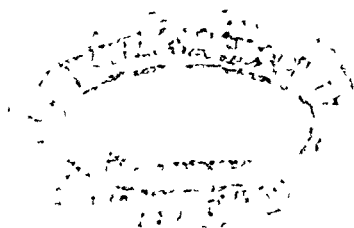
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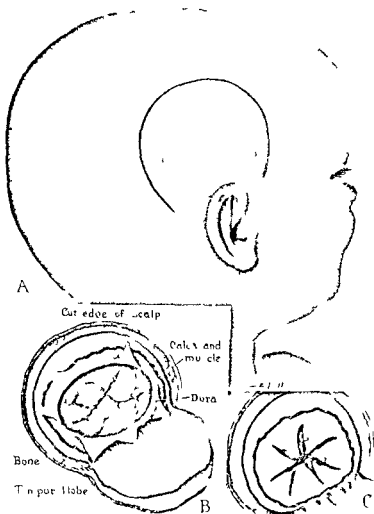


Fig. 1. A. Incision and extent of bony defect. B. margin between layers. C. dura as left before closure.

A MODIFIED SUBTEMPORAL DECOMPRESSION FOR USE IN INFANTS AND CHILDREN

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IN the treatment of neurological disorders in infants and young children, one is occasionally faced with an urgent need of increasing the capacity of the cranium. In general the skulls of young infants enlarge spontaneously by rapid separation of the sutures. The elasticity of the dura being distinctly limited, however, operation may be necessary in order that the brain may not be compressed by it. In children between the ages of 2 and 12, separation of sutures occurs at an increasingly slow rate, and surgical decompression may be badly needed.

The operation described by Cushing¹ in Ochsner's *System of Surgery* in 1920 was suggested primarily to relieve discomfort and save vision in patients with intracranial tumors which could not be localized. It has served its purpose satisfactorily in the hands of many operators and has long been the procedure of choice in adults and in older children with well developed bones and muscles. It has

been apparent on numerous occasions, however, that the increase in the capacity of the cranium achieved by this technique as employed in very young patients has been so slight as to be scarcely worth while. In 1936, Cone and Penfield² described their method of performing a subtemporal, as well as suboccipital, myoplastic craniotomy by which they gain a relatively large decompressive opening. It has the advantage of permitting rapid exploration which is not possible through the muscle splitting incision. However, the success of this procedure depends on a well developed temporal muscle which can be sutured to the bone, thus precluding its use in the group of patients referred to here. The very simple modification of technique described here has proved so useful that it has seemed worth while to suggest its more general use.

As shown in the sketch, the scalp is incised as for a small bone flap. The right side is used in definitely right handed children and in infants so young that it is not clear which is the dominating

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¹Cushing H. in Ochsner, A. J. *Surgical Diagnosis and Treatment*. Philadelphia: Lea and Febiger, 1920.

²Cone, W., and Penfield, W. Subtemporal and suboccipital myoplastic craniotomy. *Arch Neurol & Psych*, 1936, 35. 1



Fig 2 G N, aged 2 years, 1 month, 6 months after bilateral subtemporal decompression



Fig 3 J N aged 5 years 2 years after bilateral subtemporal decompression

hemisphere. The initial incision is carried down to the superficial fascia overlying the galea, and the scalp thus freed is retracted so that the next step may be made accurately. Incision is then made through the galea down to the bone about 1 centimeter from the cut edge of the scalp. This layer, including the attachment of the temporal muscle, the muscle itself and fascia, is then reflected with the scalp, leaving a relatively large area of bone exposed. A burr hole is made and the bone rongeuired away only throughout the lower portion of the wound. An opening of about 4 by 5 centimeters can be made even in very young infants. Thus there is left a broad ledge of bone between the scalp incision and the actual decompression. This relatively large exposure is necessary to insure firm closure of the temporal muscle attachment, the decompression itself being limited to the area covered by the muscle. The dura is opened in the usual way by a stellate incision well within the limits of the bone defect. Closure is accomplished by very careful suture of periosteum, galea, and superficial fascia in one layer, except in the lower portion of the wound where the temporal muscle can be closed separately. This must be done very accurately, but when so done results

in firm union with essentially a new attachment of the temporal muscle. The skin is then closed as usual. Black silk sutures are used throughout.

This operation obviously takes longer than the simpler linear incision and muscle splitting exposure, but is tolerated very well, and the obvious advantage of the additional room obtained usually more than offsets the undesirability of increasing the length of the operation.

This operation has been carried out with considerable satisfaction in numerous conditions other than intracranial tumors in infancy and childhood. It may be of interest to mention lead encephalopathy with edema in which there is often an urgent need for decompression. In fact this procedure has recently been carried out with good result as a preventive measure in such a patient when the pressure and the total protein of the cerebrospinal fluid were beginning to rise. Bilateral operation is frequently necessary in these cases, as it usually is in oxycephaly and scaphocephaly with increased intracranial pressure. This modification of technique is not suggested for exploration and is obviously less useful than the Cone Penfield procedure except in very young patients in whom fairly wide decompression is needed.

THE MECHANICAL PROBLEM OF UNMODIFIED BLOOD TRANSFUSION

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THE therapeutic indications for blood transfusion are well established and have been adequately reviewed and emphasized by Bishkow, Blain, Miller, Doles, and others. Methods of blood typing and testing of blood compatibilities are well standardized (9), assuring excellent protection to the patient. It is the opinion of Bernheim, Bishkow, Field, Heineck, Herr, and others that if blood transfusion is indicated, unmodified blood is usually preferable. Blain, Brines, Brooks (3, 6, 7), Head, Unger, Scannell (20), Lindemann, and many others have made definite contributions to solving the problem of the transfer of unmodified blood from donor to recipient, but in spite of these efforts, much is to be desired in the actual solution of the problem.

The instruments designed by Unger, Scannell (20), Brines, and others have, in the hands of the designers and of expert transfusionists, produced very satisfactory results, but in the hands of less expert operators, have frequently been disappointing. Because the occasional operator so frequently fails in the transfer of the desired quantity of blood, he is quickly prejudiced in favor of the more easily accomplished and almost universally successful citrate method. Lewisohn (15), the originator of the citrate method, ably defends (16) it as equivalent to unmodified blood transfusion, but Bernheim, Bishkow, Field, Heineck, and Herr maintain that citrated blood is not as valuable and carries a greater hazard of detrimental reaction.

Every surgeon who uses unmodified blood transfusion will fully appreciate its difficulties and disappointing complications. The slightest delay in accomplishing successful venepuncture of donor or recipient will almost certainly result in plugging of one of the needles, thus interrupting the operation before the desired amount of blood has been transferred. Any delay at any time after starting the first venepuncture is disastrous. Needles or conduits plug with fibrin, syringes stick, so that apparatus must be frequently rinsed or changed. If a single time-consuming incident occurs, the operation is likely to be a failure.

Clotting was the cause of discouragement in the early attempts at blood transfusion (Blundell),

and fibrin precipitation is still an unsolved problem. Factors promoting fibrin precipitation are rough surfaces, slowing of the blood stream, injury to cellular elements, stagnation of blood, and time. In every syringe or pump device, one point of positive and continuous stagnation is the point of contact between the piston end and the blood column. Here precipitation quickly occurs, and from this nidus quickly spreads over the end of the plunger to drag against the walls of the syringe. With the forward movement of the plunger, the fibrin film drags between the plunger and the barrel of the syringe, macerating the cellular elements, thus providing an essential element of rapid fibrin precipitation. With this stimulus, fibrin quickly precipitates on the syringe barrel. With the forward excursion of the plunger, the first, thin fibrin film is scraped off in small shreds to be liberated in the blood stream as minute emboli or, if larger, to plug the needle in the recipient's vein. With the maceration of the first cellular elements between syringe plunger and barrel, fibrin precipitation accelerates and the film quickly thickens to the point of embarrassing or entirely inhibiting the movement of the plunger. To prevent positive freezing of the syringe, rinsing or changing is necessary, and this delay promotes precipitation in the various channels of the instrument.

If the supply from the donor is slow, the time element becomes a factor, but efforts to hasten the flow by increased suction may result in air filtration between plunger and barrel of the syringe with the resulting accumulation of air bubbles. The presence of air further promotes coagulation and presents a constant hazard of air embolism.

Believing that any contribution to the simplification of transfusion would be a stimulus to the popularization of this valuable therapeutic procedure, study of the subject was begun in 1927. The first approach to the problem was an effort to shorten transfusion time and to minimize the liability of coagulation by establishing a continuous flow of blood between donor and recipient. This was accomplished by the use of reciprocating syringes, one syringe filling as the other discharged, thereby establishing a continuous

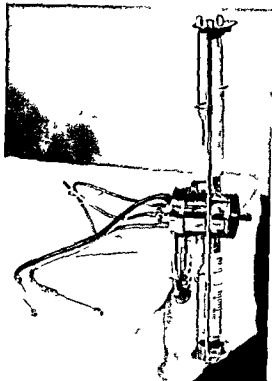


Fig. 1. The instrument in position for the downward thrust of the traveling frame to which the pistons are attached. The upper syringe is in position for discharge to the recipient.

flow of blood with no areas of intermittent or total stagnation. This result has also been accomplished in a similar manner by Brines, Janes and by the Martin modification of the Unger instrument. Record syringes were used; the plungers of which were supplied with an irrigating mechanism to prevent freezing. The reciprocating syringe in instrument design was completed and constructed in 1930 and in the hands of the designer worked very well. It was not, however, a satisfactory contribution to simplicity, as the irrigating set up was too complicated. Also the double channel valve which connected the two syringes had elements of danger in that it was possible for the operator to become confused and reverse the blood stream. For these reasons the instrument was not at that time considered as suitable for general use.

The instrument which is now to be described retains the reciprocating syringe principle and we believe embodies elements of simplicity, security and convenience not previously reported. The

syringes are mounted radially upon a hub rotatably assembled upon a spindle; the operative position being vertical. The spindle is channeled with an intake port communicating with the mouth of the dependent syringe and with a discharge port communicating with the mouth of the upper syringe. The instrument is supported by a frame clamped upon an arm board or table. The pistons are attached to a traveling frame and move simultaneously so that with the downward stroke, the upper syringe discharges to the recipient while the lower syringe fills from the donor. At the completion of the downward stroke the latch holding the hub is automatically released and the syringes are rotated through a half circle thus bringing the filled syringe to the top and the empty syringe to the lower position. In this position the automatic latch again locks the hub and the downward thrust of the frame carrying the plungers is repeated. The weight of the traveling frame with pistons attached assists in this downward thrust and is sufficient at the beginning of the operation to keep saline trickling through the needle into the vein of the recipient while the operator is engaged in completing the venipuncture of the donor. Also during the operation there is a continuous gravitational assistance as the blood from the donor flows downward into the dependent syringe while the blood from the upper syringe flows downward into the vein of the recipient. This gravitational pull assists in minimizing the propelling pressure and suction required thereby protecting the cellular elements of the blood from injury by too great an alteration of negative and positive pressure.

We believe that we have a unique improvement in the syringe used which may be adapted to any syringe method. The syringe is the standard Luer with hollow piston but the end of the piston is not closed thus making the cavity of the piston continuous with the cavity of the syringe. Near the open end of the piston shallow spiral grooves on its outer wall communicate with the cavity of the piston through small perforations in its walls. In preparation for the operation the instrument and all channels are filled with 1 percent sodium citrate solution. This is subsequently replaced with saline before the operation is begun but the citrate solution in the pistons remains in position. This converts the piston into a fluid plunger with a citrate fluid contact between the end of the plunger and the blood column. Air is easily evacuated from the pistons by an upward and downward stroke which evacuates the air from the lower syringe when the hub is rotated and the upward downward stroke is repeated to

evacuate air from the syringe just rotated into the dependent position. The upward stroke is never used during transfusion and is used only for purposes of irrigating the syringes or, as just described, in evacuating air from the plungers of the syringes preparatory to the beginning of the transfusion. When the preparation is completed, the plungers of the syringes and the grooves of the plungers are filled with citrate solution.

The fluid contact between the piston end and the blood column eliminates the most potent point of fibrin precipitation, and with each excursion of the plungers the citrate filled grooves on the pistons wipe the syringe barrels with citrate solution, thereby inhibiting fibrin precipitation. The standard Luer Lok is used to attach the syringe to the hub ports and the piston ends are anchored to the traveling frame by a slot lock so that either syringe can be quickly and easily removed and substituted.

The instrument is easily cleaned as all channels are straight. It is simple enough to be easily comprehended by a novice, while proficiency in its use is quickly acquired. The downward stroke alone is used during transfusion and the instrument will not reverse the blood stream upon the upward stroke, as the channels are not in contact and the automatic latch does not release with the up stroke, so the danger of contaminating the donor with blood from the patient is absolutely eliminated.

The harassing air bubble which will occasionally sneak by pistons or through connections can be entirely ignored, as it rises to the top of the fluid-filled plunger in the discharge syringe which is in the upper position so that the bubble is far removed from any danger of being forced into the patient's circulation. The same is true of oil, hence it is possible to lubricate the syringes and plungers with citrated vaseline, thereby further inhibiting the precipitation of fibrin upon the syringe barrel without any danger of oil droplets entering the circulation. The air bubble, instead of being a hazard, may even be beneficial in displacing downward some of the citrate solution in the plunger, thereby refreshing the citrate concentration at the fluid blood contact at the end of the plunger. The amount of citrate which may mingle with the blood at the citrate blood contact is very trivial and would not exceed 10 cubic centimeters of 1 per cent solution or 15 grains. The precipitation of fibrin may be further inhibited by the use of a chilled citrate solution, or if the small amount of citrate is undesirable, chilled saline may be used instead of the 1 per cent citrate solution.

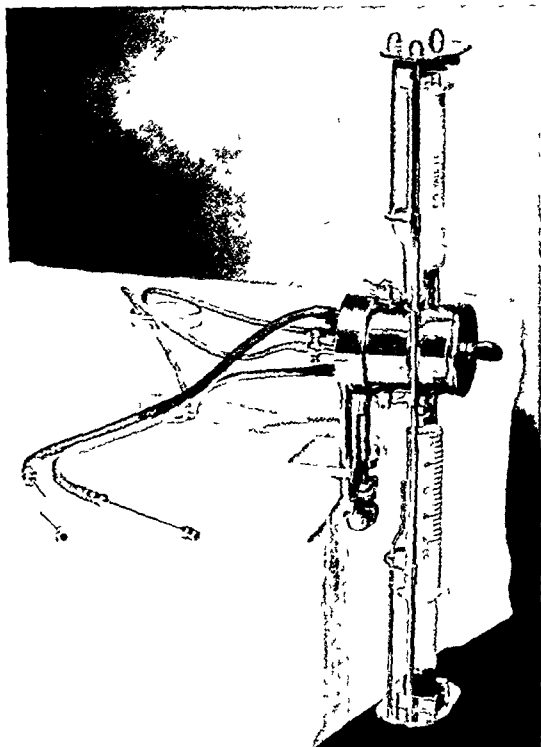


Fig 2 The instrument at completion of the downward thrust with the discharge syringe empty, the lower syringe filled from the donor, the automatic latch released preparatory to rotating the syringes about the spindle

The instrument is adapted to any standardized technique such as described by Christopher. Before sterilization, the plungers of the thoroughly cleansed instrument are lubricated with sterile vaseline, preferably carrying 1 per cent sodium citrate. Steam pressure sterilization is preferable. The donor and recipient are placed on parallel cots or operating tables with arm boards or an arm table extending between them. The entire arm of each is thoroughly cleansed and sponged with alcohol before being placed on the sterile draped arm board. The forearm and hand of both donor and patient are now covered with sterile drapes. A tourniquet is applied to the recipient's arm near the axilla and a blood pressure cuff to the donor. The sterile instrument is firmly clamped to the margin of the sterile draped arm board or table and the ends of all tubes are placed in a container holding 1 per cent sodium citrate solution. By operating the instrument, all the channels, syringes, and plungers are filled with the citrate solution. The end of the tube to the donor

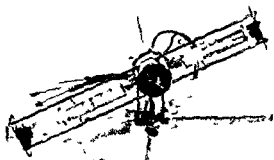


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After the needles or cannulas are removed sterile dressings are applied. The instrument is thoroughly rinsed and immediately cleansed preparatory to sterilization.

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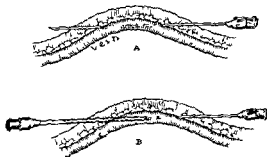


Fig. 5 A Left, Diagrammatically showing longitudinal fixation of the vein. B Diagrammatically showing venepuncture the transfusion needle being used as a stilet guide.

The puncture is made painless by a small novocain wheel at 2 points over the vein about 1.5 inches apart. With a small gage needle, the vein is picked up and punctured through one of these wheels. The needle is then passed along in the vein and out through the second wheel, after it traverses the vein for about 1 inch. The large transfusion needle is introduced into the vein, the transfixion needle being used as a stilet guide. The vein is punctured with the point down and the needle is passed into the vein until resistance is felt where the small transfixion needle emerges from the vein. Both needles are left in position until all preparations for making connection are completed, when the transfusion needle is slightly withdrawn and rotated until the point is up and the bevel toward the lumen of the vein, then the transfixion needle is withdrawn and connection is completed as blood appears at the end of the puncture needle.

In very small, collapsed, or deeply buried veins, where dissection of the vein becomes necessary, longitudinal fixation greatly expedites the introduction of the cannula. When the vein is exposed, it is transfixed longitudinally as described. With the fixation needle as a guide, a nick is made in the vein under the needle and the cannula is quickly inserted, the fixation needle being used as a stilet guide.

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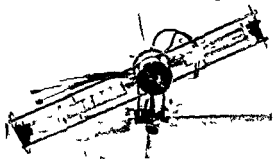


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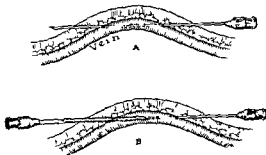


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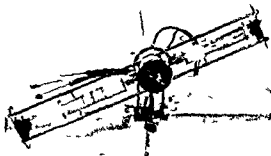


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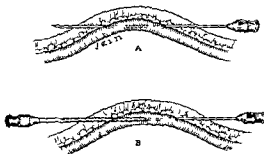


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TABLE I — PERFORATIONS OF GASTRIC CARCINOMA—133 CASES

	No of cases	Per cent
Diagnosis confirmed by		
Postmortem	66	49.6
Surgery	45	33.8
Surgery and postmortem	5	3.8
Clinical evidence	17	12.8
	133	100.0

TABLE II — DISTRIBUTION ACCORDING TO SEX AND AGE

Sex	No of cases	Per cent	Average age, years
Males	116	87.3	53.9
Females	17	12.7	49.2

TABLE III — TYPES OF PERFORATION

Type	No of cases	Per cent
Classical	69	51.8
Obscure	64	48.2
	133	100.0

diagnosis. In 42 cases, or 31.6 per cent, a diagnosis of perforated carcinoma of the stomach was made and proved to be correct by either surgery, autopsy, or both. In the great majority of those cases which were diagnosed accurately, the patient was in the hospital at the time the perforation occurred. Many had palpable masses and in some roentgen-ray studies were suggestive of malignant lesions. When the patient was first seen after the perforation had occurred and the abdomen was board-like with widespread tenderness, further examination revealed very little to differentiate this condition from a perforated peptic ulcer or perforation of some other hollow viscus. A history of rapid weight loss, vomiting, and constipation, occurring in a middle aged man who has suffered little, if any, from previous dyspepsia, weakness, and epigastric pain, is given considerable weight in diagnosing a malignant perforation. Of the 42 cases correctly diagnosed, 35 were perforations into the general peritoneal cavity. Only 7 times was the obscure type of perforation correctly diagnosed.

Fluoroscopic examination of the abdomen showed free air to be present above the diaphragm in 24 cases. Credit should be given to Vaughn and Singer (18, 19) for having pointed out and stressed the importance of this finding in perforations of hollow viscera. Had this method of examination been carried out routinely, the diagnosis, no doubt, would have been accurate in a far greater number of cases. It is strongly recommended that this method of examination be used more frequently.

TABLE IV — VARIOUS FINDINGS INVOLVED IN THE SERIES

Symptoms and findings	No of cases, present	Per cent	No of cases, absent	Not stated
Hematemesis	59	44.3	69	5
Constipation	83	62.4		33
Diarrhea	12	9.0	88	33
Palpable mass	78	58.7	55	
Weight loss	94	70.6	2	37
Tarry stools or occult blood	108	81.1		25
Free acidity	16	30.1	37	80
Positive blood Wassermann	8	6.0	109	16
Virchow's node	10	7.5	81	42

HEMATEMESIS

Fifty-nine patients, or 44.3 per cent, gave a history of hematemesis and 69 were without this symptom. With the exception of 3 cases, all the hemorrhages were of the limited recurrent variety. In 5 cases there was no reference made to hematemesis. Ransom and Collier state that in 46 cases, 50 per cent of the patients had hematemesis.

WEIGHT LOSS

Perforations in carcinoma of the stomach generally follow lesions of long standing and for this reason weight loss is a rather constant finding. Of the 133 cases, 94 were reported as having lost weight. Only 2 patients in the entire series gave a definite history of no weight loss. A mention of weight loss was not recorded in 37 of the cases. Very often when the perforation was of the classical variety the history of extreme weight loss was helpful in making the correct diagnosis. The greatest weight loss in the series was noted in a patient who had lost 80 pounds in the preceding 3 years and 6 months.

PALPABLE MASS

As stated before, with a classical perforation the abdominal muscles are rigid and little can be elicited by abdominal palpation. With this in mind we studied the records to ascertain just how often a mass in the epigastrium had been found. There were 78 patients, or 58.7 per cent, who were found to have had palpable masses. Many of the perforations occurred while the patient was in the hospital and the finding of the mass was recorded on the chart prior to symptoms of perforation. In 55, or 41.3 per cent, of the patients no mass was palpated.

STOOLS

A history of tarry stools or the symptom of occult blood was found in 108, or 81.1 per cent, of

PERFORATION IN GASTRIC CARCINOMA

A Study and Report of 133 Cases

R W McNEALY M D F A C S, and R F HEDIN, M D, Chicago, Illinois

THE opinion seems to prevail that perforations in carcinomatous stomachs are rare. Two cases of frank perforation encountered within a few months prompted us to make a study of all cases of carcinoma of the stomach which had been admitted to Cook County Hospital and Wesley Memorial Hospital during the past 12 years (1915-1927). In this period 3,289 patients were admitted. There were 133 cases (Table I) in which perforation had occurred. In 66 cases, or 49.6 per cent, diagnosis was confirmed by autopsy in 45 cases or 13.8 per cent, the diagnosis was substantiated by surgery, in 5 cases or 3.8 per cent, diagnosis was established at operation and later confirmed by autopsy. Thus in 116 cases, or 87.2 per cent, of this series the diagnosis was confirmed. There were 17 patients who were not subjected to surgery nor did they come to autopsy, but they had symptoms and findings that were characteristic of perforated gastric carcinoma. These somewhat questionable ones are included in this survey. The incidence of perforation of gastric carcinoma in our series is 4.04 per cent which does not differ greatly from previous reports (6, 7, 9). The question may be raised that these figures are entirely too low because, of the total deaths in the 2 institutions only about 70 per cent come to autopsy. This low rate of postmortem examinations provokes the feeling that if it had been possible to examine all cases of carcinoma of the stomach the percentage of perforations might possibly reach a much higher figure.

A review of the literature reveals only a few reports (1, 2, 3, 8, 14, 17, 23) of any considerable series of cases of gastric carcinoma with perforations. They are mostly statistical and in many instances no adequate study has been made of the relative frequency of various symptoms and findings as an aid in establishing an antemortem diagnosis. In reporting our series of 133 perforations we were of the opinion that something might be added to our knowledge of this phase of the subject.

From the Department of Surgery, Northwestern University Medical School and Wesley Memorial and Cook County Hospitals.

SEX

Of the 133 cases studied, 110 were males and 17 were females (Table II). This preponderance in males may be explained by the higher incidence of gastric malignancy in the male (12) and also by the fact that men are subjected to greater physical exertion and trauma. Many perforations occurred during strenuous effort (11).

AGE

Wahl (12) states that peptic ulcers usually perforate before the patient has reached the age of 40 while gastric carcinomas perforate after the age of 40 has been reached by the patient. In our series the average age for patients with carcinoma perforation was 53.7 years, the youngest being 7 and the oldest 80. For 17 females, the average age was 49.2 years and for the 110 males 53.9 years.

TYPES OF PERFORATION

We have grouped the cases of perforation into the classical type and the obscure type (Table III). All patients who suffered a sudden stabbing pain in the abdomen with subsequent findings of perforation, or those in whom perforation into the general abdominal cavity was proved by autopsy or surgery to have occurred, are classified as the classical type. In this group there are 69 cases or 51.8 per cent. The obscure type includes those patients in whom the onset was marked by abdominal pain which may have been excruciating (*forme frust*) or dull in character, but who later did not develop signs and symptoms of a diffuse peritonitis. Such perforations were found by autopsy or surgery to be well localized abscesses which had not extended diffusely into the general abdominal cavity. In this group we placed 64 cases or 48.2 per cent, of the entire series. It is significant from this fairly even incidence of the classical and obscure types that in many cases the diagnosis is difficult to make. Auld states that of the 79 cases which he collected from the literature a correct pre-operative diagnosis was made only 5 times.

With this in mind we carefully reviewed our records to see how often the diagnosis had been made correctly and what symptoms and findings were the most helpful in arriving at the

TABLE VII — PATHOLOGY FOUND SECONDARY TO PERFORATION

Pathology	No of cases
General peritoneal cavity (diffuse peritonitis)	53
Perigastric abscess	34
Gastrocolic fistula	15
Subdiaphragmatic abscess	12
Perforation with multiple liver abscesses	5
Perforation into pancreas	4
Perforation into anterior abdominal wall	2
Pylorogastro-gastric fistula	2
Gastrocholechochal fistula	2
Perforation into and around spleen	1
Gastrojejunal fistula	1
Perforation into left lung	1
Perforation into right lung	1
	133

PATHOLOGY SECONDARY TO PERFORATION

Perforations into the general peritoneal cavity occurred in 36 patients who came to surgery or autopsy. These cases, together with the 17 cases which are listed as proved by clinical evidence in this series, would bring the total to 53 cases, or 39.8 per cent.

Localized perigastric abscesses were found in 34 patients and gastrocolic fistulas in 15. Twelve perforations resulted in subdiaphragmatic abscesses. Other less frequent pathological findings incident to carcinomatous perforations are included in Table VII. It will be noted that some of these lesions are capable of extending and forming abscesses which may perforate into adjacent viscera or into the chest.

Regional nodes (20) were found to be present in 76 patients studied at autopsy or surgery. This finding suggests that perforations usually occur late in the disease. Many of the nodes, however, were not studied microscopically and may have been inflammatory in character.

SURGICAL PROCEDURES

In reviewing the 133 histories of patients with perforated gastric carcinoma, it was interesting to note that in only 63 of the patients was any type of surgery attempted. Many were moribund when first seen and could not be given the benefit of surgery. Others were operated upon under the diagnosis of an "acute abdomen" while still others were thought to be suffering from perforated peptic ulcers. As will be noted from Table VIII, the surgeons were confronted with various technical difficulties which were dealt with by several different methods. In 23 cases simple closure of the perforation with or without drainage was done. Posterior gastro-enterostomy was done in 7 cases. An anterior gastro-enterostomy was done

TABLE VIII — TYPES OF SURGICAL PROCEDURES

Procedures	No of cases
Simple closure, with or without drainage	23
Posterior gastro-enterostomy	7
Anterior gastro-enterostomy	7
Gastro-enterostomy (type not given)	7
Resection of stomach (Pólya type)	7
Drainage of peritoneal cavity only	5
Exploration of peritoneal cavity without drainage	4
Gastro-enterostomy and entero-enterostomy	1
Closure of perforation and appendectomy	1
Closure and gastrostomy	1
Patients not operated upon	70
	133

in 7 cases. The operation record was indefinite in 7 other cases, but one could conclude from the record that either an anterior or a posterior gastro-enterostomy had been done. From this it will be seen that 21 cases were submitted to gastro-enterostomy to relieve the obstruction after the perforation had been closed. Gastric resection of the Pólya type was done in 7 cases.

SURGICAL RESULTS

Of the 63 patients operated upon, 37 died within the first 10 days giving an immediate operative mortality rate of 58.7 per cent. Thirteen patients lived to survive their operations but died within the next 2 months. Of the entire group of 63 patients only 13 lived to be discharged from the hospital as improved. No follow-up was reported on the survivors so no "permanent" recoveries are recorded. It was interesting to note that of the procedures done on the 13 "survivors," 5 had resections of the Pólya type, 4 had gastro-enterostomies, 3 had simple closures, and 1 had a gastrostomy. The necropsy reports on many of the simple closures showed that there had been leakage at the suture line. The friability of carcinoma and the attendant difficulties in suturing perforations of these lesions are further emphasized when we realize that only 3 of the 23 patients who had simple closures lived to be discharged from the hospital. On the whole, the poor general nutritional state and the age of the patient were also pertinent factors governing the mortality.

From the discouraging end-results as disclosed in this survey, we are prompted to hypothesize on procedures which might give better results. We believe that when the patient has suffered a perforation of a gastric carcinoma 2 factors are to be considered, namely, the closure of the perforation and the removal of the malignancy. Generally, when first seen, the condition of the patient is so desperate that extensive surgery is contra-

TABLE V — SITE OF CARCINOMA AS SHOWN BY AUTOPSY, SURGERY OR X RAY

Site	No. of cases
Lesser curvature	45
Prepyloric	28
Cardiac	20
Greater curvature	11
Undus	6
Anterior wall	4
Posterior wall	3
Posterior wall or pylorus	3
Pars media	3
Antrum	3
Entire stomach	1
Unknown	1
	8
	133

TABLE VI — AUTOPSY OR BIOPSY REPORT—
TYPE OF PATHOLOGY PRESENT

Pathology present	No. of cases
Adenocarcinoma	27
Ulcerative carcinoma	20
Ulcerative adenocarcinoma	12
Medullary	5
Scirrhus	4
Ulcerative medullary	4
Medullary adenocarcinoma	3
Anaplastic	3
Fungating adenocarcinoma	1
Ulcerative polypoid	1
Ulcerative scirrhus	1
Papillary medullary	1
	82

the cases. In 25 cases there was no mention made of tarry stools, or of stool examinations for blood. It has been stated that bleeding peptic ulcers rarely perforate. This obviously does not hold true in perforations occurring in carcinomatous ulcers, since 81.1 per cent of the perforations reported in this series of cases showed gross or occult blood in the stool.

Constipation was present in 83 cases, or 62.4 per cent. Diarrhea was listed in 12 cases, or 9.0 per cent, and 5 cases had alternating diarrhea and constipation. In 33 cases there was no reference made to any alteration in bowel habit.

ACIDITY

Free hydrochloric acid was found in only 16 of the 53 cases, or 30.1 per cent, in which gastric analyses were done.

VIRCHOW'S NODE

The presence of a palpable node in the left supraclavicular space was demonstrated in 10 or 7.5 per cent of the cases.

SYPHILIS

It has been suggested that syphilis might favor perforation but we were unable to find that there was any correlation between perforating gastric cancers and syphilis. In both hospitals routine serological examinations are done on admission. In 100 cases of our series the blood was reported as negative. In 8 the reports were positive. In 16 no report was made.

SITE OF CARCINOMA

It will be noted from Table V that no region in the entire stomach is immune from malignancies that perforate. The sites of carcinoma listed were taken from operative, autopsy, and roentgen ray reports and the terms used in the reports were not always definite. It will be noted however that

the lesser curvature, prepyloric region, and cardiac end of the stomach were the most frequent sites of perforation. Of the 17 cases of perforation included in this series which were proved only by clinical evidence, 9 patients had undergone previous x ray examinations which revealed typical malignant appearing lesions, and 8 had no roentgen ray studies made.

Aird states that of the 79 cases which he collected from the literature, over 50 per cent of the patients were in bed at the time the perforation occurred. We studied our records in an endeavor to find out just where the patient was at the time of the perforation. We found that 71 or 53.5 per cent, were either in bed in the hospital or in bed at home. Sixty-two or 46.5 per cent were not confined to their homes but were working or walking around at the time of perforation. Of those working, many were indulging in strenuous physical exertion at the time. One unfortunate victim was cheering at a baseball game when seized with a stabbing pain in the abdomen. Surgery revealed a perforated gastric cancer to be the cause of his pain.

ULCER HISTORY

We will not enter into the controversy (4, 5, 10, 22) of cancerous ulcers and ulcerous cancers of the stomach. Suffice it to say that of the 133 cases, 24 or 18 per cent, had typical peptic ulcer symptoms for many years prior to perforation.

TYPES OF CARCINOMA WHICH PERFORATE

Eighty-two patients, or 61.7 per cent, were studied as to the type of carcinoma present. Seventy-one were studied at autopsy and in 11 patients the diagnoses were made from tissue removed at the time of operation. Adenocarcinomas and those listed as ulcerative carcinomas most frequently perforate. The entire group is included in Table VI.

- 13 McKENZIE, R E, and PRIESTLEY, J T Acute perforation of gastric carcinoma Proc Staff Meet Mayo Clin, 1937, July, 12
- 14 PERRY, SIR COOPER, and SHAW, LAURISTON, E Malignant disease of the stomach, between 1826-1900 Guy's Hosp Rep Vol 58, p 121
- 15 PERSSON, MAURITZ The final results of gastric resection for cancer—Seraphimer Hospital, Sweden Ann Surg, 1927, 86 321
- 16 RANSOM, H K, and COLLIER, F A Carcinoma of the stomach, observations on surgical treatment J Michigan S M Soc, 1932, 31 87
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- 19 VAUGHN, R T., and SINGER, H A The value of radiology in the diagnosis of perforated peptic ulcers Surg, Gynec & Obst, 1929, 49 593
- 20 VERBRUGGHEIN, ADRIEN Intramural extension of gastric carcinoma Arch Surg, 1934, 28 566
- 21 WAHL, A Ein Fall eines Magenkarzinomas das in die freie Bauchhahle perforierte Inaugural Dissertation, Univ of Leipzig, 1925
- 22 WALTON, A J Carcinoma of the stomach. Brit M. J, 1929, 1 939
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indicated. All effort should be directed at closure of the perforation and relief from any existing obstruction. Removal of the malignancy when possible should be reserved for the time when the patient is better able to withstand a more formidable procedure (13).

A primary resection is the ideal method of treatment (15). Closure of the perforation with or without a gastro-enterostomy followed at a later date by a resection is probably the procedure of choice in most cases.

It is our belief that a biopsy should be done of all perforations of the stomach. Occasionally patients with gastric perforations, which are closed and thought to be on a benign ulcer basis, return after several months with an inoperable carcinoma. A routine biopsy would obviate this situation and give the patient the benefit of radical surgery at an earlier date.

SUMMARY AND CONCLUSION

1. Of 3280 cases of gastric carcinoma admitted to Cook County Hospital and Wesley Memorial Hospital during the period 1925-1937, there were 133 perforations (4.04 per cent).

2. The group of perforations is divided clinically into the "classical" and "obscure" types. The classical type includes those cases which clinically appeared to be perforations into the general peritoneal cavity. The obscure type includes those cases in which there was localization of an abscess or a sealing off of the perforation. Both types are quite evenly represented in the series of cases.

3. The condition was correctly diagnosed in 31.6 per cent of the cases. Free air in the peritoneal cavity as shown by fluoroscopic examination was found to be a valuable diagnostic procedure.

4. A study of the incidence of the various symptoms and findings is presented. It is stressed that after perforation has occurred examination of the abdomen is quite difficult and that a careful history must be relied upon in making the diagnosis.

5. As shown by our series of cases, cancer of the stomach may perforate irrespective of the location of the lesion. However the lesser curvature, prepyloric region, and cardiac end are the most common sites.

6. Of 71 cases submitted to pathological examination adenocarcinoma, ulcerative adenocarcinoma, and ulcerative carcinoma accounted for 50 perforations.

7. In 53 cases, including 17 which were not proved to be perforations but which had quite

typical clinical findings, the perforation occurred into the general peritoneal cavity. Perigastric abscesses, gastrocolic fistulas, and subdiaphragmatic abscesses were also common sequelae of obscure perforation.

8. Various surgical difficulties were found in the 63 patients operated on, and various types of operations were done. In 70 patients no surgery was attempted, either because a diagnosis could not be made or the condition of the patient did not warrant surgical intervention. The immediate operative mortality rate was 58.7 per cent. Only 13 patients left the hospital as improved.

9. The surgical treatment in perforation of carcinoma of the stomach should be to aim at radical removal of the carcinoma. Simple closure of the perforation with or without a gastro-enterostomy to relieve any obstruction, is usually the only procedure attempted immediately following the perforation. More formidable procedures such as partial resection of the stomach must often be reserved for a later date when the patient is in better condition to stand extensive surgery.

10. It is our opinion that if a biopsy were done of all perforations thought to be due to benign peptic ulcers many would be found to be malignant. If this routine were carried out many patients might have the benefit of early resection.

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EDITORIALS

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SURGERY AND RADIOTHERAPY IN THE TREATMENT OF CANCER

DURING the past two or three decades fundamental change in methods has been the order of the day throughout all branches of medicine. The internist has experienced tremendous alteration in his management of diabetes, pernicious anemia, the nephritides, cardiovascular disease and a host of other affections that are combatable now with new, or greatly improved, weapons. Likewise, the surgeon has accepted the introduction of many innovations, some in the technique of surgery, others in pre-operative and postoperative treatment, still others in the fundamental indications for surgical treatment.

While some of the changes seem revolutionary enough today, nevertheless they do not approach in scope those necessitated by the discovery of bacteria and the introduction of

antisepsis and asepsis. Only sixty odd years ago, within the professional recollection of some surgeons still alive, Lister's principles elicited not only disbelief but active resistance on the part of many of the medical profession. In the light of our present knowledge it is hard to realize that the antagonism of thinking, intelligent men could have gone to such extremes of intolerance. Although the surgeon is probably more tolerant of change today, he still tends to eye with at least suspicion anything that represents very much of a departure from the established habit. This is especially true when changing trends seem to threaten the removal of certain diseases in part or in whole from the previously accepted field of operative surgery.

Probably in no field of surgery is this so well illustrated as in the treatment of malignancy. In 1913, articles in SURGERY, GYNECOLOGY AND OBSTETRICS from the clinics of distinguished surgeons voiced the general feeling of the time when they stated that the greatest hope in treating carcinoma of the cervix uteri lay in wide excision of the primary growth. In 1938, just twenty five years later, the bulk of evidence indicates without doubt that radiotherapy, with radium and the roentgen ray in combination gives far better results than radical surgery, now or at any time in the past. Some surgeons, however, still persistently adhere to the use of radical operations of the Wertheim type in at least a part of the patients whom they are treating who are suffering with carcinoma of the cervix. They give ground grudgingly.

Twenty five years ago carcinoma of the breast was treated almost exclusively by surgery. Today radical surgery is still the method

of general choice but evidence indicating the value of radiotherapy is accumulating so rapidly and surely that in some form it is commonly employed as a supplementary procedure. Some surgeons are so dissatisfied with the effectiveness of radical mastectomy and so impressed by the evidence indicating the benefits of radiation therapy that they are treating certain groups of patients with locally administered radiotherapy alone. Others, in search of still more effective therapy are investigating the supplementary treatment of mammary cancer, especially in younger women, through sterilization by x-ray irradiation of the ovaries. This form of therapy may foreshadow the accumulation of more evidence that carcinoma is a local manifestation of a systemic abnormality and, hence, may be solved by some type of systemic therapy rather than by local therapy.

Carcinoma in many other parts of the body might be mentioned to illustrate still further the changing trends in surgical and radiation therapy. The common factor in each instance, however, is the improvement in the character of available radiant energy and the betterment in the methods of its application. Higher voltage x-ray machines, better methods of filtration, more general availability of radium element and emanation and many other technical advances, as well as the training of more experienced radiotherapists, will give a real impetus to radiotherapy as a therapeutic agent in the next few years. The recently developed cyclotron, which makes it possible to imbue almost any substance with radiant energy, opens a field of unlimited possibilities. A great number of animal experimentations and clinical investigations, of course, must be carried out before its usefulness can be definitely determined, but if it is established it may well revolutionize the treatment of malignant tumors. With so much development going on in

the field of radiotherapy, the surgeon must be prepared to receive sympathetically and in the spirit of constructive, rather than destructive, criticism the experimental and clinical evidence that will be presented. In some instances the data will no doubt justify and amplify the now accepted surgical principles, in others the facts will, equally without doubt, cause the abandonment and replacement of some principles that today seem so fundamental and inviolate. There is, of course, always the possibility of the too uncritical acceptance of methods that are presented without proper and adequate fundamental study and evaluation. This extreme may be as unfortunate as the other. The pendulum swings periodically. It will require experience and discrimination for each surgeon to decide the amplitude of his swing and to avoid going to extremes in either direction.

The fundamental evaluation of, and comparison between, surgery and radiotherapy can be carried out most successfully only through close association between the surgeon, the x-ray therapist, the radium therapist, the surgical pathologist, the postmortem pathologist, and the experimental physiologist. This association perhaps reaches its ideal in the "tumor clinic" type of organization. In such a group, the patient with a tumor and the patient that has been treated for a tumor are observed and data recorded so that the results in the individual and in series of individuals may be studied and compared. Each physician contributes of his own specialized knowledge of the disease and benefits through the correlation of various viewpoints. Through this kind of concerted effort will come the basis for the establishment of improved methods that will be a credit to both the surgeon and the radiotherapist in the safest and best management of the patient with cancer.

CHARLES BRUCE MORTON.

LIFE OR DEATH OF THE FETUS A NEW GRAPHIC TEST IN PREGNANCY

AMONG the many signs of pregnancy, the few positive signs are those which reveal the presence of the fetus. Only two of them tell whether the fetus is alive. One consists in hearing and recording the fetal heart beat by means of the stethoscope, the other, in observing active or passive movements of the fetus. Both signs depend on subjective information and may be mistaken. It occurs not infrequently in the course of pregnancy, especially in the course of labor, that doubt exists as to whether the fetus is still alive. Important surgical decisions may depend on the correct and immediate diagnosis. An objective, unprejudiced method, independent of suppositions, is needed to fill this gap in obstetrical diagnosis.

After electrocardiography had become an indispensable method in medicine, repeated attempts were made to obtain the fetal electrocardiogram in the course of pregnancy. They failed for various reasons. In the first place nobody knew how a fetal electrocardiogram superimposed on that of the mother would look. In the second place, there was no proper technique developed and the sensitivity of the apparatus did not seem sufficient.

To overcome the difficulties, investigators started work on domestic animals¹ the fetuses of which are larger than those of human beings. After the action of the fetal heart had been demonstrated unequivocally in the electrocardiograms of pregnant mares the next step was to apply to pregnant women the technique and the knowledge gained. Deviations regularly occurring in the electrocardiogram of the human mother, corresponding to

the rhythm of the fetal heart beat, were obtained.^{2, 3}

After identification of the fetal cardiac impulses in the electrocardiogram of a pregnant woman had become possible, it remained to improve and simplify the technique so that increase in the percentage of positive results would render the method applicable for routine purposes. Complicated electrotechnical experiments, and changes in the apparatus which were necessary during the experimental stage, had to be eliminated if the test was to come into daily use. The investigators, therefore, observed the following principles:⁴ (1) Any modification of the electrocardiographic apparatus which was generally in use was avoided. (2) Unusual leads, such as placing of electrodes in the rectum or vagina, or on the abdomen were not employed. Application of electrodes to extremities is familiar to everybody and, therefore, preferable to fetal electrocardiography. (3) In spite of these limitations, it was necessary to increase the sensitivity of the test, in other words, to increase the amplitude of the various waves. At the same time, it was necessary to decrease the tremor of the tracings, that is, to eliminate as far as possible, muscular fibrillation and interference from the outside, especially that attributable to electric current.

The main points of the final technique which was developed on the basis of these three principles in short are: (1) The patient was placed flat on her back on a couch. (2) The skin and the electrodes were moistened with saturated saline solution. (3) The electrodes were placed on the upper parts of the arms and left thigh. (4) The electrodes were fastened with bandages which had been soaked

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in saturated saline solution. (5) The patient rested 10 to 15 minutes before the electrocardiogram was taken (6) Tracings were taken with the usual leads, I, II, and III (7) The electrode was changed from left thigh to right thigh (8) Tracings then were repeated with leads II and III (right arm—right thigh; left arm—right thigh, respectively) (9) Two feet (61 cm.) of film were exposed for each tracing. (10) Disturbances from other electric apparatus were guarded against. The five leads thus applied covered the main directions which the axis of the fetal heart might have in the body of the mother, projected on a two dimensional field

During the last two months of pregnancy, with the technique here described, about 87 per cent of fetal electrocardiograms were positive That is, a negative result did not mean that the fetus was dead, but a positive result was definite proof that the fetus was alive

The closer the approach to term, the higher was the percentage of positive fetal electrocardiograms, corresponding to the increasing size and increasing strength of the electric impulse of the fetal heart. In the last three weeks the percentage of positive fetal electrocardiograms ran up to 94 if the fetus was in vertex presentation Among these cases the percentage of positives was higher than among breech presentations owing to the fact that in the presence of breech presentations the fetal deviations were deflected above the zero line and therefore were recognized with somewhat more difficulty (because of the confusing positive maternal waves) than were the fetal waves in the presence of vertex presentation, which appeared deflected below the zero line. On the other hand, the diagnosis of breech or vertex presentation could be made without examining the patient, on account of the direction of the waves A fetal electrocardiogram was regarded as positive only if it

was possible to follow the fetal waves all through the tracings and to give the exact fetal heart rate. The fetal waves occurred regularly, in a rhythm independent of that of the mother The size of, and the distance between, the fetal deviations were constant The fetal waves appeared first in that lead which was almost parallel to the axis of the fetal heart. The larger the fetus, that is, the later in the course of pregnancy, the larger was the number of leads which became positive and this made the diagnosis much easier It was found justifiable to expect that 75 per cent of all electrocardiograms taken in the last two months of pregnancy would be positive in at least two leads and about 30 per cent in four leads There was no use in taking electrocardiograms before the last third of pregnancy, since the fetal heart action was too weak to exert any visible influence on the tracings obtained by the technique adopted by the investigators

Fetal electrocardiography is not to be considered as another pregnancy test but is meant to determine, during the last period of pregnancy, especially during labor, whether the fetus is alive. For instance, in some cases in which patients are rather fat, the fetal heart cannot be heard, even in the last days of pregnancy A positive fetal electrocardiogram in such cases would give definite proof that the fetus was alive.

The main practical field for fetal electrocardiography, apparently, will be in the course of labor, when active movements of the fetus usually stop and listening for the fetal heart beats by means of the stethoscope does not always give convincing results Furthermore, to have electrocardiographic tracings might occasionally be of medicolegal value To be able to produce tracings showing that a fetus was alive at a given time might be useful under certain circumstances.

Besides being of practical importance, it would seem that fetal electrocardiography opens a wide field for research. The relationship between the cardiac action of the mother and that of the fetus under normal and under pathological conditions can be studied on the basis of records of documental value. The influence of type and duration of labor, of various presentations and complications, of all kinds of drugs, including narcotics and anesthetics, of disturbances in fetal circulation (loops and knots in the umbilical cord) and so forth, on the fetal heart action are problems which might be investigated. On the basis of these studies it might be possible to make a more exact prognosis concerning the life of the fetus under various conditions. Still there is a certain percentage of cases in which babies are stillborn but in which stillbirths

had not been expected when labor was in progress. Fetal electrocardiography might become of great assistance in decreasing the number of those undesired surprises in the delivery room.

Concerning twins, fetal electrocardiograms are interesting. Without examining the patient otherwise it has been possible to make a diagnosis and to state whether one fetus is in vertex presentation, the other in breech presentation, and so on, from the direction of the fetal waves alone.

Fetal electrocardiography requires some experience in taking and reading the tracings, thus can be acquired by any obstetrician. It is still a new method which can be improved. However, it has possibilities of being of value for practical, for medicolegal, and for scientific purposes.

ERWIN O. STRASSMANN

MEMOIRS

JOHN LINCOLN PORTER

JOHN LINCOLN PORTER, the son of Samuel and Harriet Emerson Porter, was born in Alstead, New Hampshire, July 2, 1864. The family traced their origin to John Porter who left England to settle in Salem, Massachusetts, in 1634. In his early childhood John Porter moved with his family to the little New England community of Walpole, New Hampshire, where his father was a school teacher, storekeeper, and lay preacher. He received his early education at Walpole Academy from which he was graduated at the age of seventeen.

After graduation from the Academy, John Porter decided to go to Chicago, where his brother Frank, some nine years older, was in the employ of Marshall Field and Company. Perhaps Horace Greeley's quotation, "Go West, young man, and grow up with the country," stirred his imagination. This was the time, too, when Chicago was rebuilding its fortunes from the disastrous fire of 1871. In any event, he joined the throng and began his career in the shipping room of Marshall Field and Company and at the age of twenty-two was sent on the road as a salesman; for three years he continued to sell merchandise over the western prairies.

There was a strong attachment between John and his brother Frank, who being older, virtually took a father's place. This close relationship endured throughout their lives. One day when out walking in Chicago, Frank noticed his younger brother's interest in drug stores where he would often loiter at the windows. He offered a suggestion and a loan of money to buy one, the result was the purchase of a store near 22nd Street and Prairie Avenue.

John Porter immediately launched himself in a new career by taking a course in pharmacy at Northwestern University, meanwhile employing a pharmacist to operate the store. Apparently the new interest stimulated him to go further, for one year after he completed his training as a pharmacist he returned to Northwestern to study medicine. For a while he operated the store and at the same time carried on his studies, but as he advanced the store was sold. In 1893, the year of the World's Fair, he was employed in the horticultural building during the summer and the following year was graduated from Northwestern University Medical School.

During the next two years Dr. Porter served as an interne in St. Luke's Hospital under McArthur, Dudley, Ridlon, and others, well known in early Chicago medical history. He always looked back on this period of training as an invaluable experience, for internships in those days were rare. At least it



JOHN L PORTER

1864 1938

instrumental through wise counsel and constant interest in directing the course of orthopedic training, teaching, and organization. Though for many years he would annually resign his office, members of the association would not permit it and even in 1938, when, for reasons of health, he seriously felt he must give up, he was again re-elected. No more fitting tribute to his sincere interest, fidelity, and devotion to orthopedic surgery could be found.

Dr. Porter was deeply interested in the development of many orthopedic groups. His was the job of organizing the orthopedic section of the American Medical Association and in October, 1937, a Silver Jubilee of the Clinical Orthopædic Society was dedicated to him as the founder. The organization was first known as the Central States Orthopædic Club and probably no meeting afforded Dr. Porter such a touching personal tribute as this one.

His third important contribution to medicine was his abiding interest in the development of the medical journals. He was elected a Fellow of the American College of Surgeons in 1913, and in 1915, was made a member of the editorial staff of the journal, *SURGERY, GYNECOLOGY AND OBSTETRICS*, a position he held for eighteen years. From the time of the organization of the *INTERNATIONAL ABSTRACT OF SURGERY* he was editor of the orthopedic section until very recent years; even closer was his association with the *Journal of Bone and Joint Surgery*, which he watched from its infancy. Through his office as treasurer of the American Orthopædic Association he was able to take a long and active part in developing this journal—the official journal of the association. No one except Dr. Brackett, its able editor, could tell the unwritten story of Dr. Porter's part in the trials and tribulations of its growth.

During the World War Dr. Porter was appointed a member of the advisory board of orthopedics, and later, as a Major in the Medical Corps, he was in charge of the orthopedic service at General Hospital No. 36, Fort Des Moines, Iowa.

For many years he was on the attending staff of St. Luke's Hospital, Cook County Hospital, and the Evanston Hospital.

Few men have devoted themselves more unselfishly to the attainment of higher standards in their chosen specialty than he did. This was to be his great contribution to medicine and he managed to do it in a way that commanded the admiration and respect of his co-workers. No orthopedic meeting was complete without his genial presence and the group of friends which constantly surrounded him bespoke a personal tribute which delighted his very soul. His death at seventy-four came sharply and decisively on August 11, 1938, in a manner, singularly characteristic of his whole life and as he would desire it—the end of a long, useful career.

ROBERT C. LONERGAN

became a definite turning point in his career and about this time events occurred which directed his course toward bone surgery. One of these was the impairment in hearing which was first noticed in medical school and which he traced to a serious illness with scarlet fever at the age of eight.

Many reminiscences remain from this early period such as the time he haggled with the hospital superintendent for ten dollars to buy some of the then little known anti tetanic serum for a hospital patient suffering from lock jaw. It was finally obtained and the patient recovered.

After leaving St. Luke's Hospital he spent his first summer in active practice, taking over Dr. Julius Hoag's obstetrical work while the latter spent the time abroad, subsequently he did the same for Dr. William Allen Pusey. He delighted to recall these short periods of "specialization", however, this was soon over and he directed his serious attention to orthopedic surgery.

In 1899 Dr. Porter was married to Ethel Quigg, the only daughter of Col. David Quigg, a Chicago attorney and former officer in the Union Army. From this marriage two sons were born.

Dr. John Ridlon, who had received his training in New York with Sayre and Taylor, was then the pioneer orthopedic surgeon in Chicago and Dr. Porter formed a close association with him. He rapidly devoted himself, with the boundless energy which he possessed, to this new work. The crippled child came to know him as a friend indeed and the Home for Destitute Crippled Children was his sanctuary. In 1900 the University of Illinois recognized his worth by appointing him Professor of Orthopedic Surgery, a position he held until 1917, when he was called to Northwestern to occupy a similar chair.

Perhaps one of the most outstanding periods in his long active life was this teaching era. At least he is best remembered by thousands of students who still tell of his rare skill. He possessed an unusual ability to talk clearly without notes and his dry clinics were exceptional. Students would carry away fundamentals that they never forgot. Such natural teachers are rare and his was a real gift. Besides this general teaching experience he was always surrounded by a smaller group of men who received graduate instruction from him. Many orthopedic surgeons of today can trace their early training to his genuine interest in their personal careers. Although from time to time he contributed papers to the surgical journals, this was not an important part of his medical life. Far more outstanding than his gift for teaching was his devotion to the organization of orthopedic surgery, the training of surgeons and the development of higher standards in that particular branch of general surgery.

In 1901, he was elected to membership in the American Orthopaedic Association. There began a long active association in which he served for thirty five years as the society's treasurer even during the year he was president, a necessity forced on him by the death of the appointed treasurer. During this time he was

The volumes are of comfortable size and the subject matter is simply divided

Dr Campbell's invaluable contribution to urology most certainly shows its 10 years of active preparation. It is the only work of its kind in any language. It belongs in every library

L. L. VESEEN.

EVERY medical student should find of value the book on *The Management of Fractures, Dislocations and Sprains*¹ because, whatever his fracture problem may be, or whatever the whims of his teacher may be, he can be sure of contact with a wide variety of treatment. Practically all of the accepted and commonly used methods are described in detail, and many other methods are outlined and considered. However, treatment is not discussed to the exclusion of other factors important in this branch of surgery. The practitioner will be equally impressed with the book because it is handled in such a way as to make immediately available the ideas and suggestions of the authors. Properly, they do not stress elaborate equipment but give the impression that common sense and a few fundamental principles, together with the ordinary working appliances, constitute good treatment.

At the beginning of each chapter is an impressive review of the essential points of the surgical anatomy of the part involved. Here also is given a method of examination by means of which a diagnosis is made. X-ray films are illustrated and interpreted, and in those instances in which the technique of obtaining proper x-ray films is important, a method of doing so is suggested.

In the opening chapter entitled "General Considerations" one finds a discussion of modern methods and the use of modern equipment in the treatment of fractures. Details for the construction of various types of overhead frames, suspension apparatus and the like are given, also there is given an outline of the type of splints and equipment which should be kept in all first aid offices and in hospitals and fracture operating rooms. For those who prefer to make their own plaster bandages, instructions are given for their preparation and use. One chapter is devoted to a condensation of the literature on the subject of healing of bone and the factors which tend to cause delayed union and non-union. Here students will find excellent microscopic illustrations of the healing process in bone. However, Figures 40 and 41 are not particularly good illustrations of the subject of non-union.

The remainder of the book is divided into chapters, each dealing with injuries to different areas. The late Dr Dowman has contributed a very readable and instructive chapter on skull fractures and brain trauma. This chapter is remarkably succinct and will be appreciated by those who like to take their surgery with a generous dash of palatable physiology. In this chapter is a useful outline for examination

when one is confronted with a case of head injury, whether or not the patient is able to co-operate.

Dr Brown's chapter on fractures of the jaw and related bones of the face is most complete. Such work, of course, is highly specialized, but the author generously discusses the problems which arise in this field from the standpoint of the general practitioner who first sees the patient, as well as from that of the plastic or oral surgeon.

The chapter on injuries in the region of the hip is long and practically all inclusive. The controversial point regarding the treatment of fractures of the neck of the femur are handled tactfully and completely, and the authors apparently have no bias in this respect and no axes to grind.

About 95 pages are devoted to injuries of the bony and nervous elements of the spine. This section is exceptionally well done, and the anatomic considerations and the lengthy consideration of the important subject of low back pain from the industrial and compensation standpoint will be valuable to the reader. This chapter is profusely illustrated with photographs and x-ray pictures, and in it one can obtain information that concerns the reduction of a fractured spine with the latest type of fracture table, and also with such tables as one might find in a farmhouse kitchen. The currently popular nucleus pulposus rupture is given space but is not discussed at great length.

This book is recommended to those who wish to keep abreast of modern traumatic surgery.

JAMES K. STACK

THE textbook entitled *A Method of Anatomy*,² according to the publishers, presents a "super-excellent" new method of teaching anatomy. Its method assuredly does involve "certain departures from tradition", but an interesting, novel approach to a science is not of necessity eminently good, and the traditional oft-times represents a discipline that should be perpetuated.

The volume does not purport to be a dissector's guide, yet some directions for procedure are introduced, but these are sketchy and do not carry the student logically through regional strata, nor do the illustrations serially portray progressively deeper levels.

It is most definitely not usable as an atlas, since the illustrations are completely or partially diagrammatic in character; they are made, throughout, from line drawings. In the entire volume there is not a single wholly accurate figure of human gross structure, the medium employed renders it impossible to portray human tissue in natural form. Were the ingenious diagrams placed in association with drawings of the type employed in the standard atlases, they would be valuable indeed; they have, however, been lifted from the category of the subordinate to that of the principal. In many instances, abbrevia-

¹THE MANAGEMENT OF FRACTURES, DISLOCATIONS, AND SPRAINS. By John Albert Key, B.S., M.D., and H. Earle Connell, M.D. F.A.C.S. 2d ed. St. Louis: The C. V. Mosby Co. 1937.

²A METHOD OF ANATOMY, DESCRIPTIVE AND DEDUCTIVE. By J. C. Boileau Grant, M.C., M.B., Ch.B., F.R.C.S. (Edin.) Baltimore: William Wood & Co., 1937.

My dear Mr. Huxley

Many thanks for your letter

and about the book

and about the book

and about the book

and about the book

and about the book

and about the book

Yours

Many thanks for your letter

I have a great deal of

more of the same book

and I have a great

deal of the same book

and I have a great

deal of the same book

and I have a great

deal of the same book

Yours

W. H. Huxley

Facsimile of autographed letter from Dr. Thomas Henry Huxley to a book publisher. Professor Huxley was very jealous of autographs. In one of his letters sold by auction he wrote: "I look upon autograph hunters as a progeny of Cain and treat the letters accordingly." Heaven forgive you if you are only an unusually ingenious specimen of the same race.

thoroughly presented with numerous microphotographs of the organisms found.

A great variety of interesting problems is taken up in this beautiful volume. The discussion is always accompanied by continual reference to the literature. Valuable reviews of periods of thyroid study of historical significance are given, such as the Kocher-Reverdin controversy in 1882-1883. An extensive bibliography and thorough index are appended. We can be grateful for the reappearance of Doctor Crotti's work in this new edition.

PAUL STARR

THE purpose of *Neuro-ophthalmology*¹ as prefaced by the author is to supply a book of moderate proportions which would supply an answer for questions regarding those subjects which form a connecting link between ophthalmology and neurology. For this purpose he has written a volume of 516 pages, well illustrated, including colored plates with a bibliography, though not extensive, furnishing a basis for further reading on a subject in question.

The subject matter discussed includes chapters on the equipment necessary for the examination from the neurological point of view of the eye, the pupil and its reactions, the muscles and nerves of the eye and its adnexa, papilledema, optic atrophy, visual tracts and cortical representation of vision, inter-

¹NEURO OPHTHALMOLOGY. By R. Lindsay Rea, B.Sc., M.D., M.Ch., F.R.C.S. St. Louis: The C.V. Mosby Co., 1938.

pretation and localization of lesions in the visual pathway as shown by the perimeter, the macula, localizing value of ocular symptoms in the diseases of the brain, abnormalities, congenital and degenerative, subarachnoid hemorrhage, tumors of the optic nerve, the region of the optic chiasm and pituitary body, ocular manifestations in diseases of the nervous system, affections of the vegetative nervous system, ocular manifestations of head injuries, poisons which affect vision, headache, and amaurosis.

Regarding the recommendations and criticism of this book, considering the author's purpose, it seems definite that the volume fills a need in ophthalmic literature. It might be stressed that the subject matter is mainly clinical and presented apparently from that point of view. It is interesting and easily read, following somewhat a lecture style with occasional reference to cases of the author, and an occasional diversion from the trend of the subject matter presented. One might be disappointed from the title in the small amount of actual neuro-anatomy and neurophysiology, or physiopathology presented but apparently this was not the purpose of the author. There are clinical statements with which one might not well agree, yet as a whole, there has been presented a wealth of clinical material in a readily accessible form, and the book is to be recommended as a link between ophthalmology and clinical neurology.

WM. H. DROEGEMUELLER.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE 1938 YEAR BOOK OF PHYSICAL THERAPY. Edited by Richard Kovács, M.D. Chicago: The Year Book Publishers, 1938.

SURGICAL PATHOLOGY. By William Boyd, M.D., LL.D., M.R.C.P. (Ed.), F.R.C.P., F.R.C.S. 4th rev. ed. Philadelphia and London: W.B. Saunders Co., 1938.

THE PRINCIPLES AND PRACTICE OF OBSTETRICS. By Joseph B. DeLee, A.M., M.D. 7th ed. Philadelphia and London: W.B. Saunders Co., 1938.

L'IPERTROFIA DELLA PROSTATA. By Prof. Dr. N. Carraro and Dr. I. Wugmeister. Preface by Prof. G. Marion. Milan, Italy: Edizione Libreria Bocca, 1938.

CLINICAL ROENTGENOLOGY OF THE DIGESTIVE TRACT. By Maurice Feldman, M.D. Baltimore: William Wood & Co., 1938.

ADVENTURES IN RESPIRATION, MODES OF ASPHYXIATION AND METHODS OF RESUSCITATION. By Yandell Henderson. Baltimore: The Williams & Wilkins Co., 1938.

THE ROCKEFELLER FOUNDATION. International Health Division Annual Report 1937. New York, 1938.

THE HEALING KNIFE; A SURGEON'S DESTINY. By George Sava. New York: Harcourt, Brace & Co., 1938.

PLASTIC SURGERY. By Arthur Joseph Barsky, M.D., D.D.S. Philadelphia and London: W.B. Saunders Co., 1938.

A HISTORICAL CHRONOLOGY OF TUBERCULOSIS. By Richard M. Burke, M.D. Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1938.

A MANUAL OF REPARATIVE PLASTIC SURGERY. By J. Eastman Sheehan, M.D., F.A.C.S. New York and London: Paul B. Hoeber, Inc., 1938.

ESSENTIALS OF PATHOLOGY. By Lawrence W. Smith, M.D., and Edwin S. Gault, M.D. With a foreword by James Ewing, M.D. New York and London: D. Appleton-Century Co., Inc., 1938.

CRANIO-CEREBRAL INJURIES, THEIR DIAGNOSIS AND TREATMENT. By Donald Munro, A.B., M.D., F.A.C.S. London, New York, Toronto: Oxford University Press, 1938.

THE 1938 YEAR BOOK OF RADIOLOGY. DIAGNOSIS. Edited by Charles A. Waters, M.D., and Whitmer B. Firor, M.D. THERAPEUTICS. Edited by Ira I. Kaplan, B.Sc., M.D. Chicago: The Year Book Publishers, Inc., 1938.

THE HUMAN BODY IN PICTURES. A visual text of Anatomy, Physiology and Embryology. By Jacob Sarnoff, M.D. With foreword by John Osborn Polak, M.D. Brooklyn, N.Y.: Physicians and Surgeons Book Co., 1927, 1938.

DISEASES OF THE EAR, NOSE AND THROAT. By Francis L. Lederer, B.Sc., M.D., F.A.C.S. Philadelphia: F.A. Davis Co., 1938.

MEDICINE IN THE OUTPATIENT DEPARTMENT, AN INTRODUCTORY HANDBOOK. By Winthrop Wetherbee, Jr., M.D. With a foreword by George R. Minot, M.D., S.D., F.R.C.P.

tions are used without key some of the abbreviations are unfortunately cryptic frequently none would be needed were the lettering less obtrusively large.

The volume cannot be employed to replace the standard textbooks since systematic accounts are wanting the regional approach requiring the author to separate his discussion of a given structure into portions to spread these widely through a chapter the common typographical aids are lacking.

But this book which is a manual of regional anatomy replete with concepts is unique in its attempt to teach anatomy in such a way that underlying principles rather than mere facts are made its chief content. The reader is surfeited with rationale, not left free to concoct his ideas from ingredients furnished by book and dissection. Admittedly no student could arrive at so many valuable notions as does Professor Grant whose years of teaching have been rich and active his experience has allowed him to furnish some of the most ingenious bits of description yet encountered in anatomical writing. For example, muscles are descriptively associated with the execution of certain common tasks as the biceps is to the act of turning a screw driver the peritoneal cavity is likened to an enormous closed bursa the genito-urinary apparatus, with adneta is compared with the bilateral immobile leaves of a book the gastro-intestinal tract (with mesentery) to a mobile leaf in midplane femoral sheath and pelvic diaphragm are treated with equal cleverness. But in the commendable desire to simplify many important details of anatomy are omitted the abdominal layers are inadequately described important visceral variations are not mentioned no discussion is given of the intimate manner in which genito-urinary parietal diaphragmatic structures are brought into relationship through the vascular system the description of the region of femoral hernia presents only the old time opinions the sling like character of the pelvic diaphragm is exaggerated Simplification becomes so demanding that what remains of fundamental description is actually quite traditional.

Professor Grant's provocative volume can scarcely be regarded as one which will replace any regular part of the student's anatomical library. It could most profitably be added to such a library. For the graduate student it would be an elixir the surgical anatomist could profitably employ it as a source book for lecture material it is a super excellent hornbook for the young teacher. HARRY AXSON.

THE theoretical principles of roentgen therapy set forth in the work edited by Pöhlle constitute a document of great value for everyone concerned in the therapeutic application of the roentgen rays. The statements relating to the physics of the roentgen rays, dosimetry, radiobiology, and radiopathol-

ogy are not likely to be essentially changed for many years to come. The chapters on radiotherapy apparatus and protection from the roentgen rays may undergo some modification with the advance of the science. As Chamberlain states in the foreword the content of this present volume is factual and constitutes a solid foundation on which to build new knowledge of radiotherapy.

The five contributors have collaborated with the editor to produce this concise and meaty text. It is really the first publication in English concerning the modern trends in radiotherapy and radiologists who undertake therapy can hardly do without it.

JAMES T. CASE

THE subject of hemorrhoids is completely covered by Pruitt² in his 170 page monograph. It is written in a concise direct and readable manner. The 73 illustrations and photographs many of which are colored, enhance the usefulness of the book. Inasmuch as a considerable portion of the subject matter is basic in character it is infinitely more suitable to the needs of the general practitioner and general surgeon than to the rectal specialist.

Chapters are devoted to embryology, surgical anatomy, physiology, methods of examination, the most suitable instruments to use for this type of work, and the various types of anesthetics applicable to the treatment of hemorrhoids. Diagnosis and differential diagnosis are followed by a discussion of the various forms of treatment. Operative and non operative methods are discussed with a pictorial description of the various accepted techniques.

In discussing the non operative methods of treatment the author advocates treating all the internal hemorrhoids at one visit. This technique may be a safe and successful procedure in the hands of a proctologist but is apt to carry an unnecessary risk when followed by the occasional rectal therapist.

Too much emphasis is placed on the practice and value of sphincter division before hemorrhoidectomy. Daring the exceptional case good regional anesthesia will make this procedure unnecessary for sphincter relaxation and for the exposure of the hemorrhoids.

The chapter on choice and evaluation of treatment is exceptionally valuable.

THOMAS JAMES MERRAS

THIS third edition of Croft's monumental tome¹ contains several hundred pages of additional material. The field has been broadened to include hypoparathyroidism and hyperparathyroidism in addition to all phases of thyroid physiology and pathology. The discussion of the thymus is complete as usual and the author's interesting studies of the relation of fungi to goiter and thyroid disease are

NEW EDITIONS: By MERRAS, C. PRUITT, M.D. L.R.C.P.S. (Ed.) F.R.C.S. (Ed.) & A.C.S. St. Louis: The C.V. Mosby Co. 1918.
L.L.C. O. THE THYROID IN PATHOLOGY AND THERAPY. By MERRAS, C. M.D. & A.C.S. L.L.D. R.I.C.S. 3d ed. Philadelphia: Lea & Febiger 1913.

THEORETICAL PRINCIPLES OF ROENTGEN THERAPY. Edited by ERNST A. PÖHLE, M.D. Ph.D. F.A.C.R. Foreword by H. EDWARDS, M.D. Ph.D. F.A.C.R. Philadelphia: Lea & Febiger 1918.

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(Edin. and Lond.) FACP New York and London Paul B Hoeber Inc, 1938

THE HOME BOOK OF MEDICINE By David Poole MD New York Greenberg Publisher Inc., 1938

UROLOGY By Daniel N. Essendrach MD, and Harry C Rolnick MD 4th rev ed Philadelphia Montreal, London J B Lippincott Co 1938

SPINAL ANESTHESIA By Louis H. Mayson A.B. MD Foreword by W. Wayne Babcock MD, LL.D. F.A.C.S Philadelphia London, New York and Montreal J B Lippincott Co 1938

HUMAN PATHOLOGY A TEXTBOOK By Howard T. Karsner MD With an introduction by Simon Fleissner MD 5th rev ed Philadelphia and London J B Lippincott Co, 1938

A TEXTBOOK OF MEDICAL BACTERIOLOGY By David I. Bolding MD and Alice T. Marston Ph.D. et al New York and London D Appleton Century Co Inc, 1938

INTERNAL HANDBOOK A GUIDE, ESPECIALLY IN EMERGENCIES FOR THE INTERN AND THE PRACITIONER IN GENERAL

PRACTICE By Members of the Faculty of the College of Medicine Syracuse University Under the direction of M. S. Dooley A.B. MD 2d rev ed. Philadelphia London Montreal J B Lippincott Co 1938

THE PRACTICE OF MEDICINE By Jonathan Campbell Meakins MD LL.D 2d ed St Louis The C.V. Mosby Co 1938

THE FUNDAMENTALS OF INTERNAL MEDICINE By Wallace Mason later A.B. MD, MS New York and London D Appleton-Century Co Inc 1938

THE RELATION BETWEEN INJURY AND DISEASE By Jewett V. Reed BS MD F.A.C.S Charles P. Emerson A.B. MD D.Sc. Collaborating E. B. Mumford BS MD F.A.C.S Indianapolis The Bobb Merrill Co 1938

DISEASES OF WOMEN By ten teachers Under the direction of Clifford White MD BS (Lond.) FRCP (Lond.) FRCS (Eng.), FRCOG Edited by Sir Conyngham Berkeley Clifford White and Frank Cook 6th ed Baltimore William Wood & Co 1938

CORRESPONDENCE

FRacture OF THE FEMORAL NECK. A RAPID AND ACCURATE METHOD OF INTERNAL FIXATION USING A FLANGED METALLIC NAIL—A CORRECTION

To the Editor In my article entitled 'Fracture of the Femoral Neck a Rapid and Accurate Method of Internal Fixation using a Flanged Metallic Nail

the third paragraph first sentence should read as follows

'This method is equally applicable for the employment of Smith Petersen nails, Kirschner wires, Telson Ransohoff wires, Moore pins or any other type of internal hip fixation

EMMETT A. DOOLEY

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